QUI TRANSTULIT SUSTINET

*To the General Assembly of Connecticut:*

In accordance with the provisions of the Act creating a STATE BOARD OF AGRICULTURE, I have the honor to present the Report for 1882–83.

T. S. GOLD, *Secretary.*

WEST CORNWALL, January 3, 1883.

# STATE BOARD OF AGRICULTURE.
# 1882-83.

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HIS EXCELLENCY HOBART B. BIGELOW, *ex officio.*

APPOINTED BY THE GOVERNOR AND SENATE.

| | | TERM EXPIRES. |
|---|---|---|
| ALBERT DAY, | Brooklyn, | 1883. |
| J. P. BARSTOW, | Norwich, | 1883. |
| J. W. ALSOP, | Middletown, | 1884. |
| S. B. WEST, | Columbia, | 1884. |

ELECTED BY THE AGRICULTURAL SOCIETIES.

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|---|---|---|---|
| Hartford County, | J. S. KIRKHAM, | Newington, | 1884. |
| New Haven County, | J. J. WEBB, | Hamden, | 1883. |
| New London County, | JAMES A. BILL, | Lyme, | 1883. |
| Fairfield County, | E. R. WHITTLESEY, | Danbury, | 1884. |
| Windham County, | ALEX. WARNER, | Pomfret, | 1884. |
| Litchfield County, | J. LEROY BUCK, | New Milford, | 1884. |
| Middlesex County, | J. M. HUBBARD, | Middletown, | 1883. |
| Tolland County, | ALFRED R. GOODRICH, | Vernon Depot, | 1883. |

ELECTED BY THE BOARD.

T. S. GOLD, West Cornwall, *Secretary.*

# OFFICIAL LIST.

Governor HOBART B. BIGELOW, *President.*

| | | |
|---|---|---|
| J. P. BARSTOW, | Norwich, | *Vice-President.* |
| T. S. GOLD, | West Cornwall, | *Secretary.* |
| NATHAN HART, | West Cornwall, | *Treasurer.* |
| Prof. S. I. SMITH, | New Haven, | *Entomologist.* |
| Prof. W. H. BREWER, | New Haven, | *Botanist.* |
| Prof. S. W. JOHNSON, | New Haven, | *Chemist.* |
| P. M. AUGUR, | Middlefield, | *Pomologist.* |

E. H. HYDE, T. S. GOLD, J. W. ALSOP,
*Commissioners on Diseases of Domestic Animals.*

JAMES A. BILL, J. M. HUBBARD, ALEX. WARNER,
*Auditors.*

# REPORT.

The Fifteenth Annual Meeting of the Connecticut Board of Agriculture was held at Hartford, Room 50, Capitol, Wednesday, January 18th, at 10 A.M., Hon. E. H. Hyde, Vice-President, in the chair. Present, Messrs. Hyde, Webb, Barstow, Warner, Day, Goodrich, Bill, Hubbard, and Gold.

The report of the Secretary was read and accepted.

Messrs. Day, Goodrich, and Gold were appointed a committee on credentials. This committee reported John S. Kirkham of Newington, as new member for Hartford County, and Alexander Warner of Pomfret, as member for Windham County, and advised that the election of members from Fairfield and Litchfield counties be referred back to the agricultural societies in those counties.

The report was accepted, and the committee discharged.

Messrs. Day and Barstow were appointed a committee to wait on the Governor and invite his attendance.

Gov. Bigelow took the chair, and officers were chosen as follows, Messrs. Webb and Warner, tellers:

Governor Hobart B. Bigelow, President *ex officio*.
E. H. Hyde, Stafford, Vice-President.
T. S. Gold, West Cornwall, Secretary.
N. Hart, West Cornwall, Treasurer.
Prof. S. W. Johnson, New Haven, Chemist.
Prof. W. H. Brewer, New Haven, Botanist.
Prof. S. I. Smith, New Haven, Entomologist.
P. M. Augur, Middlefield, Pomologist.

E. H. Hyde,
T. S. Gold,
H. L. Stewart, } Commissioners on Diseases of Domestic Animals.

J. M. Hubbard,
James A. Bill,
A. Warner, } Auditors.

The Secretary reported his action in inviting Hon. George B. Loring, Commissioner of Agriculture, to address the Board in the Hall of the House of Representatives February 8th, and on motion of Mr. Webb, the President, Gov. Bigelow, was requested to communicate the invitation of the Board to the Commissioner.

On motion of Mr. Webb,

*Resolved*, That a committee be appointed on time, place, and subject for next winter's meeting.

Committee, Messrs. Gold, Hubbard, and Day.

On motion of Mr. Day,

*Resolved*, That the Vice-President and Secretary be authorized to assign delegates to Fairs.

.On motion of Mr. Webb,

*Resolved*, That the Cattle Commission be authorized to employ such veterinary assistance as they may think necessary.

The report of the Treasurer was read, and referred to the Auditors.

Board adjourned to 2.30 P. M.

Board met according to adjournment at 2.30 P. M., Hon. E. H. Hyde in the chair.

E. H. Hyde was appointed as Trustee of the Storrs Agricultural School.

On motion of Mr. Webb,

*Resolved*, That a committee be appointed to meet any committee of the Legislature on the subject of disposing of the horses of H. S. Merwin, and to secure some amendment of the law on glanders.

Committee, Messrs. Webb, Barstow, and Warner.

On motion of Mr. Webb,

*Resolved*, That the usual sum of $100 be paid to Mr. P. M. Augur, the Pomologist, for his services.

*Resolved*, That the Auditors be authorized to audit the bill of Dr. Sullivan when presented.

The Board then adjourned *sine die*.

T. S. GOLD, *Secretary*.

HARTFORD, January 18, 1882.

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## ASSIGNMENT TO FAIRS.

CONNECTICUT STATE FAIR, Meriden, Sept. 19–22. Gold and Augur.

NEW LONDON COUNTY, Norwich, Sept. 26–28. Day.
Mystic, Sept. 21–23. Day.

FAIRFIELD COUNTY, Norwalk, Sept. 12–15. Bill.
Danbury, Oct. 2–7. Bill.
Ridgefield, Sept. 19–22. Bill.
Union, Monroe, and Huntington, Sept. 26–28. Whittlesey.

WINDHAM COUNTY, Brooklyn, Sept. 19–21. Goodrich.
Woodstock, Sept. 11–13. Webb.

TOLLAND COUNTY, Rockville, Sept. 29, 30. Kirkham.
Tolland Co. East, Stafford Springs, Oct. 5, 6. Kirkham.
Union, Somers, etc., Enfield, Oct. 4. Whittlesey.

HARTFORD COUNTY. No Fair.
Pequabuck, Bristol, Sept. 27, 28. Warner.
Simsbury, Oct. 3, 4. Buck.
Suffield, Buck.

NEW HAVEN COUNTY. No Fair.
Woodbridge and Bethany, Woodbridge, Sept. 10, 11. Hubbard.
Milford and Orange, Milford, Sept. 19–28. Alsop.
Guilford, Sept. 27. Augur.
Southington, Oct. 11–13. Augur.

LITCHFIELD COUNTY. No Fair.
Harwinton, Oct. 3. Whittlesey.
New Milford, Sept. 27–30. Whittlesey.
Union, Falls Village, Sept. 12, 13. Buck.
Watertown, Sept. 26–28. Alsop.
Woodbury, Sept. 13, 14. Webb.

MIDDLESEX COUNTY. No Fair.
Chester, Sept. 28. West.
Clinton, Oct. 4. Augur.
Westbrook, Oct. 10. Hubbard.
Killingworth, Sept. 27. West.

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A meeting of the Board was held at Room 50, Capitol, Hartford, July 5th, at 10 A. M., at the call of the President.

Mr. Webb was chosen chairman. Present Messrs. Webb, Goodrich, Warner, Bill, Hubbard, Barstow, Gold; also, J. W. Alsop, M.D., of Middletown, and Mr. S. B. West of Columbia, appointed as members by the Governor in place of Messrs. Hyde and Stewart, whose terms had expired.

On motion of Col. Warner they were accepted as members of the Board. The organization of the Board was completed by the appointment of J. P. Barstow as vice-president.

Mr. Stewart resigned his position as Cattle Commissioner, and J. W. Alsop, M.D., was chosen as his successor.

The Board then adjourned *sine die.*

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A special meeting of the Board was held at Rockville, Dec. 13th, at 9 P. M., J. P. Barstow, vice-president, in the chair.

The secretary presented a communication from Charles H. Owen, Esq., in regard to a proposed law for a joint commission to investigate the contamination of streams by waste from factories and sewage. The subject was discussed, and laid on the table.

The secretary presented a call from the Hon. George B. Loring, the Commissioner of Agriculture, for the appointment of delegates to a series of conventions to be held in Washington, beginning Tuesday, Jan. 23, 1883. The following delegates were appointed: Prof. W. H. Brewer, Col. A. Warner, T. S. Gold, and J. LeRoy Buck.

The Board adjourned to Dec. 14th, at 9 P. M.

The Board met according to adjournment Thursday, Dec. 14th, at 9 P. M.

The question on recommending the passage of the bill referred to the Board by Mr. Owen, was taken up and freely discussed, Messrs. Wells of New Britain and Kirkham of Newington, testifying to the necessity of some protection to humanity and our live stock from the sewage of cities.

The following resolutions were then passed:

*Resolved*, That the Board of Agriculture recommend to the next General Assembly a favorable consideration of the general features of House Bill No. 68, published with proposed laws in statutes of 1882.

*Resolved*, That the secretary be directed to report to Mr. Owen the action of the Board.

The Board then adjourned *sine die.*

T. S. GOLD, *Secretary.*

WEST CORNWALL, Dec. 14, 1882.

## FARMERS' CONVENTION.

The winter meeting of the Board was held at Rockville, beginning on Wednesday, Dec. 13th, and continuing three days. The attendance was unusually large, and the proceedings of much interest and importance.

The meeting was called to order at 11 o'clock on Wednesday, Dec. 13th, by J. P. BARSTOW, Esq., of Norwich, Vice-President of the Board, who called upon Rev. J. W. BACKUS of Rockville to invoke the Divine blessing.

### PRAYER.

O Lord! Thou art the maker of our bodies and the father of our spirits, in whom we live and move, and have our being. Thou art the benefactor of our days. We adore thee as the God of our homes, of our hearts, and of our industries. Thou givest sunshine, and rain, and fruitful seasons, and fillest our hearts with food and gladness. We desire to thank thee, O Lord, for the pleasant auspices under which these meetings begin, and we invoke thy blessing upon this Board of Agriculture, representing so large and important an interest in our ancient and beloved commonwealth. We desire, O Lord, to invoke thy blessing on all the proceedings of this institution this day, and the days that are to follow. Wilt thou give light and wisdom. In all their deliberations may there be new light and new knowledge added to what we already have, that may be available in the promotion of this great work, which is the primeval work of man.

O Lord, do thou enable us, in all these deliberations, to acknowledge thee as the giver of these great gifts. We desire to thank thee this morning for our homes, their industries, and their social life; for the habits of reading and study, and good neighborhood, and honest work, that have been fostered in the home; and we desire to thank thee for the wonderful influence the home has had on these hills and

in these valleys, with the church and with the public school, to develop character and human welfare, to found institutions of civil and religious liberty, and to promote education and the means of general culture throughout the commonwealth.

We recognize, O Lord, this great interest as the underlying interest of all others, as the basis of all others, and we do beseech thee, grant to all who are here present, and to all who are represented by those here present, to have a higher estimate of this great interest, and to apply all the new knowledge that we have through the advance of science to the development of these home farms, and especially of the home sentiment, so that wherever our people go in this broad land, the home virtues may go, and make this a prosperous and a happy people.

O Lord, we ask thy blessing upon all those who shall make addresses upon particular topics connected with this great interest. Do thou lead their thoughts and their hearts, and do thou prepare the hearts of all who hear to receive solid benefit. And, O thou God of our fathers! thou God of our commonwealth, and of all our new country, we pray that thou wilt grant that our people may forever be a sober, an industrious, a frugal, a benevolent, large-hearted, generous, and happy people, accomplishing for the world what the world waits to see accomplished in this western land.

Our Father, let thy blessing rest upon the officers of this Board, and guide them in their moments of doubt and of difficulty, if they have such, and let these meetings be felt as an impulse for good throughout our commonwealth for the year and the years that are to come. We ask it for Jesus' sake. Amen.

## INTRODUCTORY ADDRESS.

By J. P. Barstow, *Vice-President.*

*Ladies and Gentlemen of the Connecticut Farmers' Convention:*

We have come to this enterprising manufacturing town for the winter meeting of the Connecticut State Board of Agriculture. Our secretary has provided a good bill of fare in that he has a lady and several gentlemen who have made the subjects on which they are to address us their special study, and they will bring us

much that will be interesting and instructive. With the aid of you practical farmers to supplement their addresses with your experience and observation, we hope that we shall have not only a pleasant but a profitable meeting.

No class of men have so large a field of observation as farmers in studying the wonderful processes of nature in both the animal and vegetable world, and although the farmer may have to labor hard to obtain his living, yet, if he will, he may have this labor lightened by the study of growth and development in nature all around him, and by this study make his daily work a pleasure.

That a great advance has been made in the improved quality of the stock kept on the farms of Connecticut, and in the modes of cultivating the soil in the last thirty years, no one who has traveled about the State can have failed to see. In nearly every pasture and farm-yard now, will be found nice full-blood or grade animals from some one or more of the noted families of Short-horns, Devons, Jerseys, Herefords, Guernseys, Ayrshires, Swiss or Holsteins, which are each, in their particular qualities, doing so much to develop a superior race of cattle to take the place of the inferior stock of Connecticut thirty or forty years ago. And with all these different families of animals to choose from, any farmer, whether a large or small one, can select such as his needs require, and such as will be profitable for him to raise and use. The rule that "the best goods are the cheapest" is nowhere truer than in the quality of stock a farmer keeps. My observation teaches me that the successful and thorough farmer is *the one* who has the best animals, seeds, and implements on his farm.

There are many causes for the great improvements in these last years; among them are farmers' institutes and cattle shows. These have brought farmers together so they could see what others were doing, and given them an opportunity to select breeding animals much better than they could otherwise have done. I think the farmers do not appreciate as they should the advantage that has come to many of the towns in the State through the sons of Connecticut, who, having gone out from the farm to some city or manufacturing center, after years of trade, or manufacturing, come back and use their wealth to fix up the old home and farm, and introduce new animals as well as new ideas of farming, thus making bright spots of the old homesteads all over the State. Instead of exciting the jealousy of the community (as sometimes occurs) these efforts should be welcomed. And the animals which

their owners' money enables them to keep should be used to benefit the whole region.

Why is it the fact that, while some farmers make money by farming, others make only a bare living? The farmer does not have the competition to meet that the merchant or manufacturer does, for a market at good prices can be readily found for everything our Connecticut farmers have to sell. Take the dairy farmer, and if he produces a prime or extra quality of butter or cheese he can find ready sale at good, remunerative prices for every pound sent to market. I know that many farmers complain that they cannot get the cost for such butter as they take to market, and the merchant or family after buying their butter once does not wish to try it again,—but I do not believe that any farmer has taken a pound of *strictly first-class butter* to any market in this State this year, without finding a ready sale at a satisfactory price. The demand for such butter is large and the supply small. If every pound of butter made and sold in the State was *extra nice in quality* it would find a quick market.

Does any one believe that it costs any more to make a pound of nice butter, that is always wanted, than to make the kind no one wishes to buy? Some one may say, "all farmers have not the skill and appliances needed to make first-class butter." If they have not, they should not try to make butter at all, but see if there is not some other farm product they can raise that will pay as well. What is true of the dairy is equally true of *all* other farm products.

Has any one ever known a farmer who has the reputation of *always* selling the best quality of beef, pork, poultry, butter, cheese, hay, or grain, not being a successful and independent man? *No*, gentlemen, this is one of the greatest hindrances to successful farming that our farmers have,—that they do not *try to make every product of the farm* just as *good* as possible; and the difference between what good articles and poor sell for will be the difference in the profits of the two classes of farmers.

A source of very great loss to our farmers is, that they do not *know* what it costs them to make a pound of butter, beef, or pork, or to raise any product of the farm. A pleasant and profitable change from the routine of labor would be the keeping of accounts, so that they could tell what crops were profitable to raise, and what animals profitable to keep. I do not believe this Board

could better expend fifty dollars than in a premium for the simplest and best system of farm book-keeping, and have it made a study in all our public schools. With such a system, any farmer could tell what any product of the farm cost him, and know what to do in the future.

I have been surprised to see how little care farmers take to inform themselves what the fertilizers they buy return them. Ask almost any one of them this question, and he will say, "My crop was better for using the special fertilizer, but how much I never troubled myself to know." *Is there any other business but farming in all our country* that could be conducted on the plan our farmers pursue? I don't believe there is or can be. If they could only know the facts, their success in some things would stimulate them to do more in that line, and knowing what they lost in other lines would make them stop the leaks, and in time their barrel would be full.

There is one new institution in our State, the "Storrs' Agricultural School," opened about eighteen months ago, that is, I think, worthy, and should have the full and hearty support of every agriculturist in this State. As is known to many of you, in January, 1881, Messrs. Augustus and Charles Storrs of Brooklyn, N. Y., gave to this State a farm of one hundred and seventy acres of land, with a commodious school building, and necessary barns and out-buildings,—all well fitted for purposes of instruction. This generous gift was accepted by the State, and a board of trustees appointed to organize the school. This school is now about to close the first term of its second year. It has now eighteen boys, between fifteen and twenty years of age; and I do not believe a better or more manly class of boys can be found in any school in the whole country. We have been highly favored in having two teachers who, besides being competent as teachers of the various branches studied, have been just the men to mould and train such young minds, and develop manly traits of character, and fit them to go out into a world that needs more men of sterling character and sound judgment. The boys of to-day will be the men of the near future.

I am glad we have one of these gentlemen here, who will tell you of its modes of study, and the work it is trying to do. Gentlemen, please inform yourselves about this school; it is the farmers' school, and should have your attention, sympathy, and

support, thus, by developing a more intelligent agriculture, become a material benefit and blessing to the State.

The PRESIDENT. I would now request the Rev. Mr. Backus to favor us with an address.

Rev. Mr. BACKUS.—I hope no one will attach too much importance to the word "Address," which our president has used. This is the first instant I have thought of addressing this convention. I should, however, feel very sorry not to be able, on the instant, to say a word of welcome, which I know the people of this valley feel towards this convention that is now assembled here.

I will say, Mr. President, that for a good many days the meeting of this board has been a subject of animated conversation; for a good many days, the programme of life has been subjected to some little modification in order to allow as much time and opportunity as possible to attend these meetings. The programme has been studied; the names of those from whom we are to have addresses have attracted attention. We are glad to see them—men representing important sentiments and interests in the State, and whose high standing awakens so much expectation on the part of those who will hear them.

We are a manufacturing community, but we never forget how entirely the manufacturing interests depend upon the farming interest. I do not see myself, although I must speak on this subject as a layman, why Ellington, and Tolland, and Vernon, and the other towns around here, cannot send cucumbers, and squashes, and fruits to the market here, and command as good prices and as remunerative returns for their labor, as can be commanded by those who raise those products in New Jersey, or at a distance, and send them by the New York & New England Railroad; when, as it sometimes happens, they suffer great damage before they get here, and sometimes fail to reach here in time. It seems to me, sir, that as citizens of a manufacturing town, it is the most natural thing in the world that we should have a warm and earnest welcome for the meeting of the State Board of Agriculture in this town

this week, and I know I speak the sentiment of all the people of this place when I say to you that we are ready, not only to welcome you with words, but in every suitable way, to express our high appreciation of the occasion that has called you together.

The PRESIDENT.—Gentlemen, I now have the pleasure of introducing to you Dr. H. P. Armsby, of the Storrs Agricultural School, who will address you upon the course of study there, and what we are trying to do.

## THE STORRS AGRICULTURAL SCHOOL.—COURSE OF STUDY.

By H. P. ARMSBY.

I have been asked to say a few words to you concerning the Storrs Agricultural School.

It is a general custom, I believe, to preface any remarks on such a subject with a panegyric on education in general and agricultural education in particular, more or less eloquent and convincing, according to the ability of the orator. I have noticed, however, while in the case of an eloquent and able speaker such an introduction may be both pleasing and useful, in the hands of a tyro it is very apt to degenerate into most "stale, flat, and unprofitable" commonplace. Moreover, it would hardly be a passport to the favor of the farmers of Connecticut to assume that such a representative body as this needed to be instructed or aroused as to the value of agricultural education.

On all these accounts, the time-honored custom will, I think, be more honored in the breach than in the observance to-day.

There is no need, either, that I should rehearse to you the history of the foundation of the School; that is doubtless familiar to you all, while the praises of the generous donors to whom it owes its existence are sounded more loudly by their deeds than they could be by words of mine.

What I shall attempt to do in the few minutes allotted me is to present to you a plain, unvarnished account of what the Storrs Agricultural School has done, is doing, and aims to do, to the end that you may have the means of judging intelligently what it is worth to you individually or to the State.

The object of the School is very distinctly set forth in the Act establishing it. It is "The education of boys . . . . in such branches of scientific knowledge as shall tend to increase their proficiency in the business of agriculture." You will observe that these words distinctly prescribe a certain class of studies, and by implication exclude others. I think no one will dispute that this limitation is a wise one. The business of farming, more than most others, brings its votaries into direct contact with nature and requires of them a knowledge, or at least an observance, of those laws of nature which it is the mission of natural science to discover and expound. Any school for the education of farmers' boys, therefore, which ignores or neglects the natural sciences is fatally defective. It may give a good education, but it is not a good education for the farmer.

Furthermore, I think a practical trial would be sufficient to convince any one that if he hoped to gain, in a reasonable time, any knowledge of natural science in its application to agriculture beyond the merest smattering of "Newspaper science," he must devote himself pretty exclusively to the work, and consent to forego to a large extent the advantages derivable from other lines of study, however great in themselves. Such, at least, has been our experience with our students thus far.

Let us, then, clear the way to a statement of what the Storrs Agricultural School is, by considering very briefly what it is not.

It is not "a little college." Neither its studies nor its methods are collegiate in their character. There are colleges in abundance, good, bad, and indifferent, for those who desire them; colleges pure and simple, and colleges with all varieties of attachments, agricultural included; agricultural colleges, too, where it is sometimes difficult to say whether the agriculture or the college is the attachment—whether the tail waggles the dog or the dog the tail. The Storrs Agricultural School does not propose to enter the lists with them.

It is not a scientific school in the common acceptation of the term. Its pupils study science, not for its own sake, but for the uses they can make of it in one particular occupation.

On the other hand, it is not a school for the benefit of those who are not smart enough to go to college or to a scientific school. In its own field and in its own way it offers fully as great an opportunity for the use of natural endowments of mind and for hard

mental work as any college or scientific school within my knowledge. While it does not reject any faithful student of average capacity, it is not, and will not be made, an asylum for incapables. It was not established to teach what are sometimes called the common English branches, such as arithmetic, geography, history, and the like. Our common-school system is supposed to bring a fair education in these subjects within the reach of every citizen, and it would be obviously a confession that the money spent on that system was wasted, to establish a special school to teach what the common schools were intended to teach.

Permit me at this point to allude to another mistaken idea which I find is somewhat prevalent concerning the School. It is that new classes are made up at the beginning of every term—after the fashion of the district school or the country academy. Such is not the case. Our students can accomplish the work laid out for them only by beginning at once upon their entrance a systematic course of study and continuing it without interruption to the end of the course. New studies are of course taken up from time to time, but they are so arranged that one thing introduces another, while some of the studies are continued through all three terms of the school year. In short, we have a carefully-planned course of study continuing for two years, and not a succession of six terms of study.

But certainly by this time you will be ready to ask what the Storrs Agricultural School *is*. I do not know that I can answer the question better than by giving a somewhat detailed account of the course of study and methods of instruction, both in-doors and out.

The student who enters the junior class begins at once the study of *Chemistry* and continues it throughout the year. He makes personal acquaintance in the chemical laboratory with those elements and compounds which chiefly enter into the composition of soil, air, plant, animal, and fertilizer, and whose properties he must understand if he would study intelligently the laws of animal and vegetable life. I venture to take time at this point to describe, briefly, the method pursued in teaching this subject, since it is typical of that pursued in all. For the first lesson the present junior class was assembled in the laboratory, each provided with a lead-pencil and a scribbling pad. After having their places assigned, and being told the names of a few common pieces of apparatus, they were

directed to put a bit of zinc in a test tube, pour upon it muriatic acid, and observe what happened, taking notes of it on their pads. After a short interval they were questioned as to what they had seen. They were then directed to apply a lighted match to the mouth of the tube, and they thus discovered that an inflammable gas was being evolved. By the aid of a few suggestions, and directions as to the use of apparatus, they went on in this way to discover for themselves and note down on their pads the principal properties of the element hydrogen. They were told as little and led to find out for themselves as much as possible. No book whatever was used at first. On the next day they were required to hand in, neatly written out in a note-book, what they had learned about hydrogen, these notes being subsequently corrected and returned to them, and another substance was taken up in a similar way. Further on in the course a good text-book was placed in their hands, but the *first* study of a new substance is always in the laboratory. It is a study of the thing and not of the text-book.

Simultaneously with the study of chemistry begins that of *Physics* or *Natural Philosophy*, which is pursued after much the same manner, except that a majority of the experiments are most conveniently made by the hands of the instructor. This study is also continued throughout the year. By it the student learns the general laws governing the construction and use of simple machines, the laws of the pressure and flow of water, of atmospheric pressure and its applications, and of light, heat, sound, and electricity.

While thus studying the general laws of matter, students also pay attention to the science of living beings, or *Biology*, including both botany and zoology. The work is usually begun in this department by a dissection by the students of some small vertebrate animal, usually a squirrel or a cat. They note the appearance and location of the internal organs, make drawings of them, and at the same time by the aid of a text-book learn the functions which the several organs perform in the living animal. Subsequent dissections serve to bring out points that may have escaped observation in the first exercise, and also introduce new facts to notice, such for instance as the location and arrangement of arteries, veins, and capillaries. In this way the study of anatomy and physiology goes on simultaneously, while general zoology receives attention by means of lectures. Particular attention is of course

bestowed on the anatomy and physiology of domestic animals. The school possesses several mounted skeletons, viz., an ox, a sheep, a dog, and a chicken, the work of Professor Koons, and also the unmounted skeletons of two horses. The students assisted at the dissection of these animals and have made particularly careful study of their skeletons.

But I shall only weary your patience by recounting in detail all the studies pursued. In addition to these mentioned, *Botany* takes a prominent place, especially in the spring months, and in connection with that study the methods of testing the vitality of seeds are taught.

*Geology* and *Mineralogy* are also studied sufficiently to enable students to understand the ways in which rock and soils have been formed and are now being formed, and to identify common rocks and minerals.

It will not have escaped your notice that the studies thus far enumerated, while they obviously may be very useful to the farmer, are not strictly agricultural studies. They furnish the student of them with a knowledge of natural laws which is very important to his future success, but they do not teach him how to apply them to farming. This latter is one of the objects of the studies of the senior year. Having, in the first year, laid a good foundation of general scientific knowledge, the student goes on in the second year to build upon that foundation the superstructure of special training for his future work. And just as the superstructure of a building attracts more attention from the passer-by than the foundation, so you may at first be inclined to consider the studies of the senior year of more practical value than those which precede them, but a moment's reflection will convince you that neither link in the chain can be omitted.

While unusable science is a worthless commodity, it is equally true that to study the applications of science to farming (or to anything else), we must first have some science to apply.

During the past term, the senior class has been studying the scientific side of *Cattle Feeding*. This study they began by a general review of the subject of animal physiology, which they had studied the year before, giving special attention to those portions of it which bear more directly on the subject of feeding and passing hastily over other points of less value for this particular purpose, and studying all with direct reference to the uses that can

be made of it. The chemistry of fodders and feeding-stuffs was taken up, and the training in chemistry which they had received in the junior year made this an easy task. They have learned something of the composition and digestibility of the common feeding stuffs, and how they are affected by soil, manuring, stage of growth of the plants, manner of curing or preserving, mode of preparation, quantity and combination on which they are fed, etc. They have learned what rations are and how they are compounded, and what rations experience has shown to be best adapted to particular objects of feeding.

Within a short time they have begun the study of *Stock Breeding* and will continue it next term, taking up the laws of heredity and variation in their application to this subject.

In zoology proper they have studied chiefly *Insects*, particularly those useful or injurious to vegetation. Much of the work has been laboratory work, and for this a generous friend of the school has recently supplied us with two excellent compound microscopes.

*Structural Botany* and *Vegetable Physiology* have also received some attention, Prof. Johnson's "How Crops Grow" being used as the text-book. A daily exercise in *Book-Keeping* has also made part of the course of study.

During the remaining two terms of this year the Senior class will continue the study of Zoology, giving more attention to the microscopic organisms, such as yeasts, moulds, fungi, etc., which play such an important part in many common operations, and some of which are the cause of deadly and widely-prevalent diseases of man and animals. They will take up the chemistry and physics of air, water, and soil as related to vegetable growth, and to the action of manures, and will learn something concerning the composition, properties, and uses of the ordinary manures and fertilizers.

Thus far I have been giving you an outline of the course of study pursued in-doors. We do not, however, confine our instruction to the school-room, but aim to utilize the farm also as a means of instruction. All students, unless specially excused, are required to engage in work on the farm at specified hours—the Senior class in the forenoon and the Junior class in the afternoon. Nearly all of our students thus far have been farmers' sons, measurably familiar with the common operations of the farm; but to any who are not we aim to teach these operations, while all, by

engaging regularly in farm work, enjoy all the advantages to be gained by regular practice under competent supervision.

Furthermore, it is intended to teach on the farm *the application of the principles learned in the class-room*, and this means something more than teaching how to plow, or harrow, or milk, or anything of that sort. After the student has learned *how* to do these and similar things, he needs to learn *when* and *why* to do them. The *Why* he learns mostly in the class-room; the *When* he must of necessity learn largely in actual practice, either on the school or home farm under instruction and supervision or by possibly disastrous experiments on his own farm. There can hardly be two opinions as to which course is preferable.

I must not occupy too much of your time. But it may not be out of place to add to what I have said concerning the aims of the school and its course of study some little information on minor points.

One of these will naturally be the expense of attending the school. The tuition has been fixed at $25 per year, payable as follows: $10 at the beginning of the first and second terms each, and $5 at the beginning of the third term. Good board, including fuel, lights, washing, and mending, is furnished at cost. Text-books and stationery are also supplied at cost price. Probably $10 per year would cover all necessary expenses of this sort, and the text-books are all standard works, which form a valuable foundation for a future library.

Considerable may be done by students in the way of self-support. The work done on the farm and about the house, except such as is performed for purposes of instruction, is paid for at reasonable rates. During the past term students have earned in this way, according to their ability and ambition, from one to three or more dollars per week.

During the summer vacation of three months opportunity is afforded to a certain number of students to remain and work on the farm, the number being of course limited by the needs of the farm.

The school year begins on the last Thursday in September and comprises three terms of twelve weeks each, with a vacation of two weeks at the holidays and one week the last of March or first of April. In the summer, as mentioned, there is a vacation of nearly three months.

Some of you may be interested to know the number of hours devoted to labor and study. Our daily programme at present is as follows:

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| Breakfast, | 7.00 A. M. |
| For the Senior Class—Farm Work, | 8–11 A. M. |
| For the Junior Class—Recitations and Lectures, | 9–12 A. M. |
| Dinner, | 12.15 P. M. |
| For the Senior Class—Recitations and Lectures, | 2–5 P. M. |
| For the Junior Class—Farm Work, | 1.30–4.30 P. M. |
| Supper, | 6.00 P. M. |

The time from 7 to 9 each evening, except Saturday, is devoted to preparation for the next day's recitations. Between those hours all students are required to be quiet and to be occupied with their books and notes. It has not been found necessary to assemble them in any one place for this purpose. Indeed, we have no "school room," in the ordinary sense. The lectures and recitations during the day-time are mostly held in the laboratories, and during the evening study-hours the students are distributed about among these and other rooms, a few in a place, and the preservation of quiet and order is left mainly to their own sense of honor and desire for study and improvement. In fact, both in this and other matters, we aim to have as few rules as may be and to trust as much as possible to the manliness and good sense of the young men; and it is due to them to say that they have, with scarcely an exception, responded readily and heartily to the appeal to their honor, and have shown a most commendable degree of interest in and devotion to their work, and one which has rendered the task of government of the lightest character.

I might add other details of the studies pursued or of the conduct of the School, but if I have said enough to give you a fair idea of what sort of a school we have in Mansfield, anything more would be a superfluous trial of your patience. If I have passed over any points on which you desire information, I trust that you will not be backward in calling for it. Indeed, your Secretary intimated pretty plainly to me when he asked me to come here that my remarks were to be simply a sort of entering wedge, and that the larger part of my duty was to serve as a target for questions. The time was when I was in the daily habit of answering (or trying to answer) questions, though the questioner was usually

one and the questions many. Of late years, however, my duties have been more in the nature of questioning others than of being questioned myself, and it may be that I have become somewhat rusty in the art of replying, but I shall cheerfully do my best to respond to any queries you may be disposed to make. It is the desire of the Trustees, and of all connected with the School, to have all citizens, and particularly all farmers, of the State know just what sort of a school it is. I am not here to give a puff for the School—to exaggerate its merits or hide its demerits—but simply to afford you information concerning it.

Gentlemen, this is *your* school. It was born in a Farmers' Convention two years ago. It will be what you make it. If you approve of it and support it, it will prosper. If you disapprove of it or neglect it, it will fail, and no money or patronage can prevent it. You cannot rid yourselves of responsibility in the matter, and if you believe at all in agricultural education, as I know you do, you must admit that you owe it to yourselves to be informed concerning this school and to exercise your power over it intelligently and justly.

The PRESIDENT. An opportunity will now be given to any persons who wish to ask Dr. Armsby any questions in regard to the School.

Hon. E. H. HYDE. It has been said that this is a School especially for the sons of rich men; that the scholars who are in attendance are those from families of affluence. I would like to inquire what the fact is in that regard?

Dr. ARMSBY. Out of the eighteen students we now have, I can recall at present but one who would answer to that description. All the others are either from families in moderate circumstances, or young men who are entirely dependent upon their own exertions for support.

QUESTION. At what age are they admitted?

Dr. ARMSBY. At fourteen.

Mr. ADAMS, of Rockville. What must be the proficiency of students in order to enter?

Dr. ARMSBY. The requirement for admission, as I stated in the lecture, is a good English education. That is, the

student must be able to read and write the English language correctly, be familiar with simple arithmetic, and measurably familiar with geography and American history.

Mr. ADAMS. Is there any limit to the number of students who can be accommodated ?

Dr. ARMSBY. Our capacity in that respect is limited by the number of dormitories at our disposal. As we are at present situated, we could not accommodate more than twenty-five or twenty-six.

Mr. STANLEY, of East Hartford. How rigid is your discipline over the boys? If a boy should come there who was wild in his habits, what is there in your discipline that would teach him to behave properly?

Dr. ARMSBY. I think he would find himself effectually restrained by the general public opinion of the School. There is a very commendable sentiment of gentlemanliness and devotion to work among the students. We have had one or two students who have come there inclined to be rather obstreperous, but they have been quite effectually toned down by the students themselves. Our simple rule is, that all students are required to conduct themselves in a quiet, gentlemanly manner, and no student will be allowed to remain in the School who by misconduct or negligence shows himself to be unworthy of its benefits.

Mr. DAY, of Brooklyn. I would like to inquire of the Professor what his ideas are in regard to the length of time that is devoted to study, and the number of hours that are devoted to labor. I think he stated something like four hours for study and three for labor. I would ask if he does not think that number of hours of labor may be too severe upon the student? It is an old adage, that "all work and no play makes Jack a dull boy," and it has seemed to me that the number of hours for study and the number of hours for labor might be so great that there would be but little chance for recreation, and for "Young America" to act out himself, which we all like to see in an honest, pleasant way. The School has now been in operation for nearly two years, and I

would like to hear the Professor's ideas more particularly in regard to the advisability of reducing the number of hours devoted to labor. Those who know me know that I am a working farmer, and I have found that when I have done my day's work, I am incapacitated for study or reading; I am exhausted. Now, I would like to ask if the hours of labor are not so excessive that a student who may be naturally dull in his studies is overworked?

Dr. ARMSBY. Undoubtedly, that is a very important point which Mr. Day has raised. I would say in reply, however, that we have never found in our experience that the work produced that effect. The hours of work are varied somewhat, of course in different seasons. During the spring term, say from April to the first of July, the hours of study are diminished somewhat, and the hours of work increased. The young men whom we have had so far are all healthy and vigorous, and do not appear to suffer any injury from the amount of work that we require of them. This term we have required a little less time in recitations than during the corresponding term last year, with perhaps some benefit. They usually find a reasonable amount of time for the effervescence of "Young America." At least, we judge so occasionally by the sounds that we hear.

QUESTION. Are practical experiments in fertilizers carried on at the Storrs Agricultural School by the students, and, if so, are the results given to the public?

Dr. ARMSBY. During the past season, we have been trying a series of experiments in fertilizers as applied to corn. The experiments were planned by myself, and carried on with the aid of the students. It would not be strictly correct to say that they were carried on by the students, but the work was done partially by the students, and they are familiar with the plan and purpose of the experiments. The results have not yet been obtained. The corn has been harvested, and some samples are now being dried for the purpose of getting, as nearly as possible, at the dry weight of the product. The results will be published in due time in the report of the School.

Mr. Hyde. I think I had the honor as well as the pleasure of introducing this subject to this Convention two years ago. At first it seemed not to strike the Convention with special favor, but after a little consideration it appeared to be unanimously in favor of sustaining this School. Now, it has been in operation two years, nearly, and I desire to ask of the President if it has received any favors in a pecuniary way outside of the original donors? I would like to know what has been realized by the exertions and the work of the President himself for the advancement of this school the present season? I ask this, Mr. President, in order that the gentlemen present may know somewhat as to how this institution is received, and whether people who have the means are disposed to bestow their mite upon it.

The President. I would say, in regard to that, that we have had quite liberal donations from a number of gentlemen in the State. I do not know the exact amount that it will foot up, but I should think we have had some seven or eight hundred dollars in value of gifts to the School. It has received commendation from a very large number of gentlemen in the State. And I will say that I have seen a good many of the gentlemen who were present at our closing exercises last year, and, without an exception, they have expressed themselves as being very much pleased with what they saw there. Many of them went there not knowing much about the School, and not feeling much interest in it, but they came away interested in the School and disposed to do what they could to help it. And I know that that is all that is needed. If the farmers of Connecticut will inform themselves in regard to the work that is being done there, they cannot help putting their shoulders to the wheel to assist in carrying it along.

Mr. Hyde. The Secretary of this Board has known very well the workings of this institution, and I desire that he should state, with all due respect to the modesty of Dr. Armsby, who is with us, the general character of the work of the professors and teachers of this school. It is important, it seems to me, to know what our working force is there.

Mr. Gold. In reply to this suggestion, allow me first to say a word in regard to the property that has been placed in our hands for this purpose. The buildings were erected and used by the Soldiers' Orphans' Home, some twenty years ago, costing from ten to fifteen thousand dollars—money well expended in substantial buildings. The farm consisted of fifty acres, and we appraised the whole property at about fifteen thousand dollars, as the lowest value that could be placed upon it. It passed into the hands of Mr. Augustus Storrs. He bought an adjoining farm of 120 acres—good, common New England land, of the variety of soil and exposure that we have here—added this farm to the original fifty acres, and gave the whole as a free gift to the State for this purpose. Really, the property could not be duplicated for less than twenty thousand dollars. Such was the value of the gift that was made by Mr. Storrs. An additional sum of six thousand dollars was given by his brother, Mr. Charles Storrs, to put the thing in working order and for drainage, and this, with the other gifts to which Mr. Barstow has referred, have been employed in stocking the farm and providing the tools and appliances for the laboratory and for teaching purposes.

And now as to our teaching force. Dr. Armsby, well known throughout the State as an assistant for many years in the Experiment Station with Prof. Johnson and Mr. Jenkins, and as the author of an excellent work upon cattle feeding, is a thoroughly accomplished educator in the department which he is called upon to teach, that of agricultural chemistry and its allied branches. Prof. Koons is a thoroughly qualified and experienced teacher of botany, mineralogy, biology, and those departments of natural history, a knowledge of which lies at the foundation of all true agricultural science. We have found in him a persistent worker and a faithful associate with Dr. Armsby. Our farmer is a good Tolland county farmer, Mr. Goddard. He is one of us, and he is prepared to teach the boys what he knows, and to show them how Tolland county farming is practised, to the best of his ability. That sums up the teaching force that our means

have allowed us to obtain, from the appropriation by the State and the other resources at our command. Our object has been (and this is the sole particular in which our school differs from most others) to educate young men *for* the farm, and not *off* from it. Bear that in mind. We impress upon our teachers that we are seeking in every way to furnish that kind of instruction, science for the farm. Keeping up their habits of manual labor, so that they shall not be afraid to dirty their hands or to soil their boots in the dew because they have been to school, but shall be just as ready to engage in any of the operations of the farm as they were before they entered upon our course of study. It is our design to give them an education that shall not only fit them for farmers, but shall induce them to continue to cultivate the farm, and to make the agriculture of Connecticut what it needs to be, more intelligent.

Mr. Allen, of East Windsor. I feel that this Storrs Agricultural School, if it fails at all, will fail because the farmers of the State do not know what it is. It is difficult to get people interested in anything they do not know anything about. I find it very difficult to get interested in anything I do not understand, or do not know much about, and that seems to me to be the great difficulty here. If the farmers of the State would visit the institution and become familiar with what is being done there, become acquainted with the professors and with the system of instruction which is carried on, and see the benefit that the pupils are deriving from it, I think they would more fully appreciate the value of that School. I have heard people laugh about it and sneer about it, and call it an elephant that the people have got on their hands to support. I have no doubt that there is a very general feeling in some parts of the State of that sort. Now, I should be very sorry to have that School fail of success because the farmers of the State did not take an interest in it, or did not know anything about it. I know that it is a valuable institution. It is a Normal School for agriculture. We have normal schools for the education of teachers for our

schools, for the education of young men for the professions, and why not for agriculture? Gentlemen who are familiar with the agricultural schools of Europe, know that they had such schools there for centuries before we began to think of having any here. In all the agricultural States of Europe they have them, graded up from the common school in agriculture to the university in agriculture—graded up regularly; and that is what we are going to have here, by-and-by, if the agriculturists of the State are awake to this business, and understand the value of these institutions. Do not laugh at it, gentlemen. Do not laugh it out of the State. Go and see it.

Rev. Mr. Backus. The Secretary's remark, that the one object of this School is to educate boys for the farm, suggested a question which I would like to ask, and that is, whether that is the effect of the education there. That is to say, do the boys learn to love farming? The more they know of it, do they want all the more to farm it in life? Do they want to go out and buy a farm and run the risk of paying for it, or do they want to get through as soon as they can and go somewhere else—learn a trade, or something of that kind? Does the School make farmers?

Dr. Armsby. Our Junior class has been with us too short a time to say anything about them on that point. Of the Senior class, I can say that, as far as I know, all the members intend to follow farming, and one of our best students is a young man whose father sent him there because he had taken a distaste for farming, and wished to learn a trade, or follow some mechanical pursuit. Since coming there he has undergone conversion, if I may call it so, is very enthusiastic on the subject, and intends to follow farming for a living.

Rev. Mr. Backus. I hope he will not backslide.

Mr. Gold. I have just had time to gather my thoughts, and I find that I made an important omission in speaking of the general force at the School at Mansfield. The Matron, Mrs. Coit, is a motherly woman, endearing herself to all the students by her careful labors and kindly interest in them.

She commends herself to our favorable notice at this time, especially as a very important member of the family that we have there.

Mr. HAMMOND, of Rockville. Mr. Gold says the boys are being educated not to be afraid of getting the dew on their boots. I want to inquire what time they get up. I inherited a farm in Colchester, and my boy has charge of it. I have been trying to get him up early in the morning, and I was thinking, if they did not have breakfast at the Storrs Agricultural School until seven o'clock, my boy had scored a point against me. What time do they get up in the Summer?

Dr. ARMSBY. There is no rule requiring them to be up at any particular time. In Summer, most of them are up as early as five o'clock. In winter, some of them lie abed later.

Mr. HAMMOND. I once worked on a farm nine weeks, and I had to get up at half-past four. I do not know what the rule is now.

Mr. JOHNSON, of Newtown. I have listened to the questions that have been put to the Professor, with interest, and I should feel ashamed of myself if I allowed this opportunity to go by without giving my testimony in regard to the workings of that School, as far as I know of them from personal observation. I was present at New Britain two years ago, when the matter came up for discussion, and I remember very well the remarks that were made *pro* and *con*. I felt interested at the time, and felt that if the School could be started in a proper way, it would be eventually a benefit to the State. I knew from the programme that we were to have a lecture from the Professor at this meeting, and I thought, in order to get the full benefit of that address, it would pay me to go up to Mansfield and see for myself; and so, week before last, I left my business and went up there, and in my visit there I had an excellent opportunity to see the workings of the School as it is every day. No one knew that I was coming,—I took them all by surprise,—and I knew no one who was there; I never had seen any of the teachers or pupils, and everything was new to me. I never had been in the place, and did not

know where I should find the School, but I was told to get out of the cars at Eagleville and foot it three miles up hill, and I should find it. I guess it is three miles!

The location is an admirable one for a school of that kind. It is away from all the bad influences of village or city life, in a locality as healthy as can be found. I think all the home influences of the School (which I consider of the utmost importance in any school) are admirable. I know of no place where I would sooner trust my boys (I have four of them) away from home, than I would under the influences of that School. The Professors, I think, are well calculated for the positions that they occupy, and in the matron, as Secretary Gold says, I think the boys have one of the most motherly and one of the best of women to take an interest in their welfare, and it certainly has the most healthful home atmosphere that I have found in any school for a long time. I commend it to the farmers of Connecticut, and I agree with the gentleman from East Windsor, that the best way, and the surest way, to inform yourselves in regard to the School is to go there some day and see for yourselves.

I spent the school hours of one day, most of them, in the laboratory, with the professors and the classes, and saw the manner in which they conduct their recitations. Everything is perfect; everything is conducted in what seems to me the best way. It is in its infancy now, and, as has been said, it is for the farmers of Connecticut to foster it, cherish it, and sustain it, or it lies in their power to kill it. We can do either one. But don't any of you say a word against the School until you have visited the institution yourselves, and informed yourselves in regard to the opportunities it furnishes from what you see. After you have been there, you will not raise any objections against the School, I think.

Col. Warner, of Pomfret. I have no doubt that the Storrs Agricultural School is well conducted, no doubt that its appointments are all that we might desire, but, in order to have any institution or business in life successful, there must be certain inducements offered. Now, the question that I want

to ask the Professor is this: If a young man came to you and asked you what inducements you could offer him to come to your institution and take a course of study, I would like to have you inform the convention what answer you would give him?

Now, a young man, when he looks around at the different professions and callings in life, may perhaps select the ministry. He goes through a course of theological study, and graduates from the institution; he is then prepared to go out into the world, take his place in the desk, and be a leader of the sacred thoughts of the people, and take a social position in life which is desirable. In other words, when he graduates his place is fixed in the community. So with the lawyer. He looks forward in his legal studies to the time when he will get his diploma, and when he gets that, and is admitted to the bar, he is then prepared for the great battle of life; his position is assured; he has got something on which he can act; his education has prepared him for the great battle of life in his calling. So, too, with the medical profession. A young man studies medicine; he goes through a medical college, he graduates, he is admitted to the medical association of his community, and his position in that community is fixed; his calling places him in a position in social life where there is no question. If he is a young man of good character (which we will suppose), there is no question in regard to any of these professions or callings in life. The position of the young man in social life is fixed; with economy and industry, his success in life is assured, with health. It is all very well, what my friend has said about young men getting up early and dirtying their hands and their boots, but I tell you, life is a great deal easier if one can get along without getting so much dirt upon him. You may talk as much as you please about the desirability of getting dirty, but I tell you that men generally do not like to get dirty, and I think a business in life where they do not get besmeared is more desirable than one where they are obliged to be continually digging in the dirt, and getting dirty all the while.

Now, we want to bring out the facts, and unless we can bring these young men to believe that it is for their interest to go to this institution, they are not going there. That is the reason why I ask the professor to state to this audience what inducements this institution offers to the young man, and whether he can tell him, when he graduates from the school, what place he is to occupy in the community. That strikes me as a little weak point. If he is a poor man—and seven-eighths of your students are poor,—when they graduate, they go from your institution with nothing but their diploma—tell me where that young man can go? Must he go on a farm and work with common laborers? For you farmers in Connecticut cannot afford to pay for the skill that he has acquired in the course of study that he has gone through. The medical man levies a contribution for the time and money that he has spent in acquiring his knowledge on all the families that can afford to pay him. What are you going to do with your student when he graduates and goes out into the world to engage in the battle of life? Where are you going to place him? on a farm that is owned by a very rich man, to tell him how to spend his money? That is not farming. And how is this institution to help the great mass of farmers? That is the class we want to reach. It is not the rich farmers, the "fancy farmers," but the great mass of farmers of the State and of New England. We want to see where we can place this student so that he will help them and benefit himself. In other words, what inducements can you offer these poor young men to study in your institution.

Dr. Armsby. It seems to me that Col. Warner has touched on a problem which reaches very far beyond the limits of any agricultural school; at the same time, I should answer his question somewhat in this way: that we can offer the young man who comes to us a good education, which will enable him to levy his contributions, not on the people that are scattered here and there in the community, but on the forces of nature, that are present every where, and on the riches that she offers him in the soil and in the products that he

can get out of it. And I think, furthermore, that the place which our students will aim to occupy, and the natural place which they will occupy, is on farms of their own, be they larger or smaller. What they learn at the school is not of a character to make them advisers, particularly, of other farmers, nor to constitute them experts in agricultural chemistry, or any kindred subject, but simply to give them such command of the forces of nature that they can use them for their own ends, on farms of their own. How they are to get such farms is not a problem that is given to the school to solve, particularly.

Furthermore, it appears to me that another inducement which we can offer them is in those mental advantages which flow from a good education of any sort whatever; those advantages which cannot always be measured in dollars and cents, but which are in the man himself, in his character, and in the place that he, by reason of his character and attainments, can hold in the community. We hope that the young men whom we graduate will become leaders in the communities where they dwell, and that they will be able so to apply to farming what they have learned in the school that they will become, to a great extent, patterns and models for those about them. Not that they will set themselves up as models—at least, we hope not—but that they will naturally become so, because they will become better and more successful farmers than others who have not been privileged with the same advantages.

Mr. J. M. Hubbard, of Middletown. I wonder if it would not be a good thing for us all to study to become ministers, doctors or lawyers, if every man who undertakes to fit himself for those professions and gets his diploma finds an "assured position in the community," and that nothing depends on his own exertions! If his place is fixed, *and fixed high up*, I think the whole community better take that course. It is not so. Not one of us who looks about him, but can see people who have fitted themselves for doctors, lawyers, and ministers, who have not "found their places fixed for them;"

who have not been "able to levy contributions upon the community," or, if they did, people would not pay them, and they have been obliged to turn aside to other pursuits. I know a man, perfectly fitted by education and training for a lawyer, who is selling coal in Middletown. I could name a good many instances, that have come within my own limited observation, where college graduates have not found their places fixed for them, by any means. The great majority of young people who grow up cannot take any position they please by simply going through college or a medical school. They have got to work for a living, and the common sense American recognizes that fact. Are they going to work at an advantage or a disadvantage? That is the practical problem before us all. And what the Storrs school aims to do is to give them the means, the ability, and the opportunity to work at an advantage, rather than a disadvantage. There must be a great many farmers. The great mass of people have got to dirty their hands and soil their boots, and be out in the dew and mud, and live a life of hard labor. We recognize that fact; we are not particularly afraid of it; do not object to it; but what we want to do is to so equip them for their work that when they have undergone these hardships, performed this hard work, it shall be effective. That is practically what the Storrs school aims to fit its pupils to do.

Now I wish to add a suggestion in regard to this matter, which some one ought to make. Every farmer in Connecticut can aid this institution. I think every one here is well convinced of the fact that what we want is the very best material in the state to work upon. Somewhere in the state there are twenty-five or thirty young men who need and want the benefits that this institution can give. We want to bring the material and the school together. If any one of you knows a good, bright boy anywhere, aiming to be a farmer (if he is aiming to be anything else, I think he better go somewhere else)—but if you know a bright, intelligent, active, energetic boy, aiming to be a farmer, bring this matter to his mind, and assure him that the hours spent there will

be thevery best investment to which he can put his time, and whatever money it costs,—it does not cost very much. That seems to me to be a practical way in which the farmers and the people of our state who are interested in the school can further its purpose and help us. Give us the very best material in this state, twenty or thirty young men—perhaps we can accommodate more, if they crowd upon us—and we will try to do the best we can. Give us the best material you can to work upon, and we will turn out something that will demonstrate the value and usefulness of the institution.

Mr. ——. Must not a young man who has graduated from that school receive additional compensation? Are there not plenty of men in this state who would pay a man something extra if he can use his brains as well as his hands? I think the reason we have all failed so often is because we have hired ignorant help, and been too much afraid of soiling our hands. I think we want intelligent help. I hope no farmer in this state will allow his lips to lisp the word "fail" in regard to this school.

Mr. LAZEBY, of Broad Brook. Napoleon said that it was the life and glory of France that her people were an agri cultural people, and he spent his money liberally toward the agricultural education of the French people. If that could be truthfully said of France in the days of Napoleon, it can with greater truth be said of this country to-day, for I see that in 1881, "Young America" exported $175,000,000 worth of meat, and $425,000,000 worth of grain—making $600,-000,000 for these two items alone, to say nothing of butter, cheese, and a score of other articles that might be mentioned, that would, in my opinion, swell the amount to $1,000,000,000. I have noticed in the papers, within a few days, that our three per cent. bonds sell higher than the consols of England —a small fraction higher. It is the $600,000,000 of exports that have brought about that result. It is astonishing England, and we would not have thought it possible forty years ago.

Speaking of agriculture, I have worked in Connecticut

and in Massachusetts. I had to begin forty years ago, at ten dollars a month and my board. I had to save my money, little by little, until I got enough to buy a farm. So these young men, when they come out of college, do not come out with a fortune; they must go to work somewhere, and save the cents and the dollars, and by-and-by they can buy a farm. They do not all come out of school or college the owners of farms: they have got to earn farms. That is the way my boys have to do, and what I had to do.

Adjourned to 2 P. M.

## AFTERNOON SESSION.

The Convention was called to order at 2 o'clock, and the President introduced as the first speaker, Miss MARY H. REED, of Amenia, N. Y.

## OUR EXPERIENCE WITH CHICKENS; OR PRACTICAL LESSONS IN POULTRY RAISING.

BY MISS MARY H. REED, AMENIA, N. Y.

"From the shell to chicken-pie, or from the cradle to the grave," is the subject of this paper; and it is intended for beginners in the poultry business, who need to know the details of the work, who have already small flocks of common fowls and wish to improve them, or who intend to purchase and "try their luck." This is not to be a recital of "great profit," or "great success," from fancy prices for thorough-breds, but a simple account of what has been done with ordinary stock, and good care, for a series of years, by one who has had at the same time many household duties.

It is a disputed point among philosophers which was first, the hen or the egg. But is it not quite plain to this audience that the hen must have been first—else how could the egg have been hatched? By an incubator—some of you may reply—but unless Eve was a Frenchwoman we doubt if she had such troublesome apparatus in her garden.

As in this advanced age of the world we can buy either eggs or

chickens, it matters little which theory we hold; but for our convenience we will begin with the egg.

When winter begins to give way to spring, which time varies some six weeks, we make preparation for the hatching. The labor and expense of trying to raise early chickens while the snow is on the ground does not pay—we have tried it, and failed. In selecting the eggs we choose the larger and perfect ones, and gather two or three times a day, and keep in a cool place. We have found that the fresher laid eggs hatch in the greater proportion; but have often kept them two weeks, or even three, and had good success; but the chances are greatly in favor of those just laid. When two or three hens are fully determined to sit, unless this should occur too early in the season, the sitting-room is prepared for their exclusive use by shutting out the other fowls, and putting it into a perfectly clean and orderly state; it is emptied, swept, and garnished. The floor is sprinkled with clean, dry earth, and covered with straw. The nests are made in movable boxes with soft hay and placed on the floor in a close row around three sides of the room. A little kerosene is poured from a can into each corner of each box. This prevents any trouble with insects and does not harm the eggs. The feeding-trough is placed through the middle of the room, and is always supplied with corn. The drinking-trough and the dusting-box on the unoccupied side of the room, with a small box of gravel, complete the outfit. There the hens stay till incubation is over, and sometimes fifteen hens live in peace after a few days' quarreling at first. And this is just where the trouble begins; but with proper care the loss from this source is far less than the gain.

In the early part of the season eleven eggs are enough for a sitting, and thirteen later when the weather is warmer. The boxes are marked with chalk—number one, two, three, etc., as the hens are set; and this enables us to keep the record correctly in our book. The hens are taken in just after dark, and if they have been properly tamed and trained they will stay where they are put; and even if they do conclude to exchange nests after a few hours, or a few days, it will do no harm, as there are only enough nests with eggs to go around, and so all are kept covered. But sometimes it happens that an old hen will not go on at all unless she can have her choice. We put her gently a few times where we want her, and if she will not obey then we make the other hen give up her place. Some-

times a giddy young creature will refuse to sit at all unless she can have her nest where she at first selected it outside the sitting-room, and we find her at all hours of the day and night wandering about the room, defying authority or persuasion. Such are soon taught better manners by a few days' cooling in an out-door coop in solitary confinement with only "bread (wheat) and water." At first the hens need close watching at about noon, when they all come off to feed; but they soon learn to go wherever they find an unoccupied nest. If others are added to this flock after the first week more care is necessary to keep them on their own nests, as a hen knows best how long she can safely leave her nest at the different stages of incubation, and to put a hen that has been sitting two days on eggs that have been covered two weeks or more would almost insure the death from chill of the chick in the shell. For a few days the hen can remain off a long time, but as the twenty-first day draws near her periods of recreation are much shorter, and a sensible hen will not leave her nest after hearing the first peep.

If an egg is broken in any nest and the remaining ones become soiled, they must be carefully washed in warm water, or the coating of egg will stop the pores of the shell and smother the chick. The nests are examined daily to see if all is right. One restless hen will often cause much trouble in this way. As the season advances and the air becomes dry it is best to sprinkle the eggs and hay towards night slightly with warm water twice; first about the fourteenth day and again the eighteenth or nineteenth. This softens the shell and so moistens the atmosphere that the lining will not dry upon the chick before it has time to release itself.

If possible a roomfull of hens is set at the same time, as it takes little longer to care for twenty than for five. When the chicks begin to hatch they are removed from the hen as soon as dry, into a basket lined on the bottom with paper, and are covered closely with a woolen cloth, and set by the fire. We once placed fifty in a corn basket and put it by the kitchen stove, and after an hour's absence, returned to find the fire increased and the poor things nearly smothered to death. They are kept in the basket two or three days until their mother, or some other hen, is ready to receive them into the coop. They will begin to eat on the second day, and this early handling does much to make them tractable.

The first foe that confronts us is the large brown louse from the

hen, which is properly a tick, and fastens itself firmly to the head of the chick: and sometimes a dozen of these giants can be found on one little pate. There they suck the blood until the poor victim grows weak and thin, and perhaps dies of gapes, or any other chicken disease that may prevail. To prevent this we used the kerosene in the nest boxes; but lest by chance one should appear, we grease the head of each one before putting it again with the hen, with a mixture of equal parts of lard and kerosene. An assistant, once, intending to make very thorough work. used so much oil it run into the eyes and caused thirty to die of blindness.

The coops are movable, with board bottoms, and are placed each year in a new spot, in the sun early in the season, and in the shade later. Twelve or fourteen chicks are given to each hen, and for a few days she is confined to her coop, but afterwards allowed liberty in the dry part of the day. She has all the corn she will eat as long as she broods the flock, and so keeps fat and warm, and often begins to lay before she weans her family.

The first food is bread crumbs, and hard-boiled eggs, with scraps from the table. If the flock is large we make coarse bread and short-cake, of middlings; and soon they can eat, cornmeal cake, or "johnnycake." All food for chickens should be seasoned as highly with salt and pepper as we season that for our own eating.

As they grow older the chicks can eat corn-meal scalded, seasoned, and shortened with drippings, tallow, or lard. If possible we get something from the butcher; the "lights" of beef make excellent food if boiled until quite tender and chopped fine, and "rough" tallow is good to mix with other food. Chickens will grow in almost the exact ratio in which animal food is given. Cracked corn, or wheat screenings scalded, comes in the next course. A pail of corn or wheat is covered with boiling water, in which a large tablespoon of salt is dissolved, and allowed to stand closely covered several hours, until quite softened. Cayenne is added in greater or less quantity as the weather is cold or hot, wet or dry.

They are fed three times daily al they will eat, and when quite young we must leave a little food ready for them, unless we choose to go out very early in the morning, for how can the "early bird catch the worm" unless the worm is waiting for him? When they are older and able to digest it, dry cracked corn and

wheat screenings, and then whole corn, is liberally fed; and when the new corn comes they will be glad to help themselves from the cob. The greatest objection to feeding corn on the cob at any time is the untidy appearance of the cobs. The only way to dispose of them is to pick them up, or rake them, and burn them; sometimes we make a bonfire, but they do not then burn very readily. Milk is a most desirable article of food, but should not be given young chicks except in curds, or mixed with meal, as it will stick up their feathers and so cause death.

To prevent the old fowls and half-grown chickens from eating the choice bits away from the little ones, we use feeding boxes made of foot boards six feet long and four feet wide, with slatted tops of lath. These are placed on blocks of sufficient height to allow the small fry to run under and exclude the taller ones.

The second foe to the flock may be the cat, the rat, the weasel, the skunk, or the fox; each of which must be treated with whip, or trap, or poison, or gun, or dog.

The next enemy will probably be diarrhea and gapes. Cooked food and warmth will probably prevent the first; and plenty of animal food, with dry warm coops, cure any tendency to the second. We have noticed that this disease usually results from, or at least follows, a cold or long rain, and the first warning we have of it is the sneezing; and in a strong, well-housed, well-fed bird, the malady will apparently go no farther; but if the chicks are already weakened by loss of blood from insects, by contaminated ground, or by improper feeding, they will surely succumb.*

Pure water must at all times be within reach of every fowl and chick; but such is their perversity that if possible to find "something stronger than pure water" they will eagerly drink it, to the immediate danger of their lives. Shallow tin platters are their first drinking cups, which are kept from overturning by a stone in the middle. These must be scrubbed daily with a small whisk broom, to insure cleanliness. For the older ones we have found a common tin pan weighted with a stone as convenient as anything. It is easily moved and cleaned, and in freezing weather can be taken to the fire to thaw.

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* NOTE. The worm producing the gapes is propagated in the soil. I have grounds so infected that it is impossible to raise one out of a dozen chicks, when allowed to range on it. Adjoining fields are entirely free from the malady.

T. S. G.

As soon as the birds weigh one pound, those not wanted for stock may be sent alive to market as broilers. They will bring nearly as much money then as when older, and will leave room for the younger ones.

When the sitting time is over, and eggs are cheap, about the last of June, is the time to send to market the fat old hens. Few are worth keeping after they are two years old. If of the Asiatic breeds they will be too fat to safely endure the summer—therefore we send them alive to the New York market. The weather is usually too hot to allow sending them dressed, especially as the majority of New Yorkers are still so far behind the times in hygienic matters as to prefer the undrawn poultry. In cool weather it will pay to undertake the extra labor of dressing; and for marketing to private families they are always drawn, washed, and made quite ready for cooking.

While fattening they are confined in a dark coop and fed corn meal scalded and seasoned with salt and pepper twice a day, with abundance of whole corn at night. Nothing should be given them for twenty-four hours before killing.

After July comes the most leisurely season to the poultry keeper, if it can ever be said he has any vacation, for it seems to us that eternal vigilance is not only the price of liberty but of eggs and chickens. Any hens that want to sit at this untimely season are consigned either to the chopping-block, or to a cool "retreat" under the apple trees, where they can meditate at will on the "might have been;" and if the old cocks crow two early, or too loud and too frequently, and so disturb the sensitive nerves of some invalid member of their master's family, they too are politely requested to share the same domicile, whose prison walls keep them from saucily clapping their wings under the chamber windows.

All the fowls have free range during the summer and fall, and are fed wheat screenings or oats once a day, and once with scalded meal and bran. Very little corn is fed in summer, but in the fall they often get more than is best for them by helping themselves at the pile by the pig-pen. Yet this is not altogether an evil, for we find when the fowls are well fed—full fed—they will continue in many cases to lay through the entire moulting season, and will renew their feathers so slowly it will make no special drain upon the system; and so they escape in great measure any inconvenience

they might feel from too sudden a change of clothing. Sometimes it happens a hen may have a little assistance in loosening her feathers; she may intrude too often on the hospitality of her neighbor in the pig-pen and be rather rudely turned out of doors, with very little clothing, as was the case with one of our own flock a few weeks since. In consequence she died in three days of "chills and fever," without the fever.

The hen-house is forty feet by ten, with ten feet front elevation, and four feet in the rear, with a shingled roof. The sides are of inch hemlock doubled with broken joints. This is divided into three rooms, the middle one sixteen feet in length. A large window is in each room, with sash in winter and lath slats in summer, which are fastened on the inside with buttons. Slat ventilations over the doors give fresh air in the coldest weather, and when warmer the front and back slat doors can replace the tight ones.

The entrance for the fowls to each room is from the rear and placed about three feet from the floor and reached by an inclined plane on the outside. A landing place about a foot square receives them on the inside. These entrances can be closed at will by sliding doors. Such small doors also lead from the middle room to each of the others.

The floor is of cement, which is easily cleaned, and it is swept as often as necessary to keep it neat; and the whole house, except the higher part of the roof, is made perfectly clean and whitewashed twice a year. A light sprinkling of dry earth is kept constantly on the floors, and over this several inches of straw. The roosting room is supplied daily with coal ashes, when the fowls are in confinement; from this they pick out much lime and small stones; and it also serves an excellent purpose as absorbent and deodorizer.

To ensure freedom from vermin the roost-poles are smeared once a month with the lard and kerosene mixture; also a large low box of earth and ashes is prepared as a dusting place. The middle room is the dining and laying room, and is supplied with feeding-troughs, water-pan, and nest-boxes. The troughs are leaned against the wall when not in use to keep them clean. The nest-boxes are movable and are set on shelves around the room.

By the first of November the old flock is reduced to those hens worthy of being kept through the winter, and to these is added a

sufficient number of pullets to make about fifty or sixty in all. The others, that have not already been marketed, are confined by themselves to wait for their fate at Thanksgiving or Christmas. Before bringing the pullets into the flock the old hens are marked by cutting off the tail feathers, and those two years old have also one wing cut; in this way we can always tell the age of each fowl.

It is necessary to confine them to the house for a season to teach the pullets that this is now their home; and at dusk they must be shut in the roost or they will spend the night upon the highest shelves; and when the snow comes they are all kept constantly indoors. They are fed twice a day; in the morning with meal and bran scalded, about one-third bran; and at four o'clock with wheat, or oats, or buckwheat, or corn. Some corn on the cob is thrown in to keep them busy; and sometimes the order of rations is reversed. All table scraps, refuse meat, and apple-parings are fed in a box provided for the purpose. As long as cabbages can be had, three or four heads a week are hung up by a string around the root, to a nail at a convenient distance from the floor, and the fowls eagerly eat all but the roots. A box of gravel and a liberal supply of pounded clam shells is always accessible. We use some cracked bone, but they seem to prefer the shells. Sixty fowls will consume a corn basket of hay every two or three days, in addition to the above bill of fare. Employment is needful for them, so all the grain is scattered in the straw that they may enjoy the luxury of scratching; and while so occupied they are not forced to pluck each others feathers for amusement; for mischief is found for idle bills as well as for idle hands; though we think the constant use of salt has something to do with preventing this bad habit.

If an egg by any accident is broken in the nest all will unite to prevent its waste by eating it speedily; and sometimes we have had just the faintest suspicion that some sharp bill helped make the crack that necessitated such luxurious diet. An ounce of prevention is here worth many pounds of cure, and the frequent gathering of the eggs when the fowls are first confined to such close quarters may save them from temptation. During the summer the shells of the eggs used for table are dried and broken and kept for winter feeding, and we have never found that this suggests egg eating.

We have had the care of poultry more or less from childhood.

but no special pains were taken to improve the flock or to keep account of results until 1866. We had the common barnyard fowl, and the average weight was probably not over two and one-half pounds.

The White-Crested Black Poland was the first foreign element introduced which increased the laying qualities.

The Dominique came next and improved the size and plumage. In 1876 we bought of Rev. Wm. Clift a late Light Brahma cockerel, and when he arrived by express every one ridiculed our purchase of the awkward creature; but he proved a magnificent bird, and was always called "Tim Bunker."

In 1877 one sitting of Light Brahma eggs that was carried six miles over a rough road produced one fine pullet, and one sitting of Cochins produced none.

In 1880 one Plymouth Rock cock was purchased, and two White Leghorns, and exchanges have occasionally been made with neighbors that had superior stock. Great care has always been taken in the selection of breeding fowls, and only the very best birds survived the block. In this way we have built up a strain we call Darwinian, that answers our purpose for both eggs and table fowls better than any full-blooded stock we could find. They are medium size, full breasted, low, deep bodied, smooth yellow legs, moderate comb, fine plumage, and amiable dispositions; good layers, good sitters, and good mothers.

One objection to the Poland, or any black fowl, is the difficulty of making them dress handsomely for market,—the pin-feathers will show, and besides the dark-colored legs are not liked by the market-men. The Brahmas are excellent for the table when fully grown and well fattened, and a cock of three or four years old is almost equal in size and flavor to a turkey; but they outgrow their feathers so rapidly when a few weeks old that the half-naked bodies are a disgrace to the lawn, and if there comes a cold rain some of them will be pretty sure to die, notwithstanding the best care. They mature so slowly that it is late in the season before any are fit for the table, and so require more care and more food. The feathered legs are another objection, as in wet, snowy weather they retain much cold and filth and often cause sore feet. Yet after all they are a kingly race, and move about with dignity, and do not take fright at a shadow and fly over our heads as the Leghorns do.

The latter tribe are not yet sufficiently acclimated to lay constantly when the weather is very cold, and the combs and wattles suffer from frost. We expect to see ere long these difficulties overcome and American Leghorns free from all fault. The Plymouth Rock is approaching perfection, and as it continues to be bred on the Darwinian plan of "survival of the fittest," we shall perhaps find in them the best breed for the majority of farmers. We have one Brown Leghorn hen several years old that lays continually, except when moulting, and we regret that we have not been able to keep a record of the number of her eggs.

The most remarkable hen of our flock is "Old Fluff," whose age is so great there is no account of the day of her hatching. She is of the Houdan family, and is *known* to be fifteen years old, and she may be thirty or forty; yet every season she hides her nest and raises a good brood, having no sympathy whatever with any of the new-fangled notions that hens should live and lay in the hen-house, but prefers the good old-fashioned way of stealing her nest in some corner of the barn, and bringing up her children in the barnyard in the improving society of the oxen, cows, and calves, with an occasional visit to the pig-pen for a dish of gossip over the swill-trough; and when the cold winter winds howl, and the snow blows and drifts into every crack, she sits sleepily on the hay-mow and dreams of her early days on Haut-Boy Hill, when

"In the barn the tenant cock
Close to Partlet perched on high,
Briskly crows—the Shepherd's clock—
Jocund that the morning's nigh."

There are difficulties in keeping poultry accounts that are not easily surmounted. For instance, we wish to know how many eggs each hen will average for the year. If we should keep all the hens one year it would be a simple problem, but we kill one or more from the flock every month, and perhaps send to market some in June and some in July; some are occupied in the sitting-room, and some are caring for their young. How shall we arrive at a just average? We have sometimes wished to keep our fifty hens from January to January, but such a plan is not practicable.

We often see in the papers such reports as this: "No account was taken of the eggs and chickens used in the family." Do you call this keeping accurate statistics? Some paper clips the follow-

ing "from the correspondence of the *Western Rural*": "What a Woman has done. In the year 1880 there were sold from thirty hens 3,500 eggs, an average of 116 apiece. Besides this fifteen fowls were added to the stock and thirty-three were marketed. No account was made of the fowls and eggs consumed by a family of four, of the eggs given to five calves and four cats, nor of those which were set." And this omission to keep the record of eggs set, and of those used in the family, we see almost daily in the reports of would-be statisticians.

If the four persons ate three eggs a day, which is a moderate estimate,—as our family of five eat four and a half daily,—they must have consumed 1,095; and if each calf ate ten eggs and each cat ten,—which you will agree is a very miserly allowance,—the whole number was 1,185; and if that family ate seven fowls apiece during the year,—which is a little less than our average,—the writer must have used about 170 eggs for sitting, which makes a total of 1,355 eggs, which to her mind are of "no account." This would make the number of eggs laid by those thirty hens 4,855, or $161\frac{5}{6}$ each, which is a much larger average than falls to most poultry keepers.

Another difficulty is the trouble of measuring the food furnished by the farm; but we did it repeatedly until we found a fair average. In our records no account is kept of the value of the manure; but if it had been it would greatly increase the apparent net profits. Some think this about pays for cost of food, but we doubt if it would pay more than half.

We keep an account of every egg laid, set, hatched, sold, eaten, or given away, and reckon all used in the family at the average selling price. Also of the chickens: the book shows the number hatched, lost, raised, sold, eaten, or given away, with the average market price of all used for home consumption.

In 1866 we find only the record of eggs laid, which was 3,168, but the number of hens is not given. In 1867 we have the following entry: 3,584 eggs laid, about forty hens,—that is, forty hens on the first of April,—and the number was gradually reduced to about twenty by the first of November, and increased again by pullets during the winter to the original number.

In 1868 the total number of eggs was 3,082; in 1869, 2,110; 1870 to 1873 no record at all; in 1873, 2,464; 1874, 3,778.

The year ending March 31, 1875, total value of eggs, $69.32;

of chickens, \$45.75; total income, \$115.07; total expense, \$23.30; profits, \$91.77.

Year ending March 31, 1876, eggs, $256\frac{1}{2}$ dozen, \$52.54; fowls, 220, \$80.72; income, \$133.16; expense, \$36.03; profit, \$97.13.

Year ending March 31, 1877, eggs laid, 3,842; sold, $246\frac{1}{2}$ dozen at 23 cts., \$52.84; fowls sold, 239 at $45\frac{8}{10}$ cts., \$109.56; total income, \$162.40; total expense, \$60.14; profit, \$102.26; there were 58 hens at the beginning of the year.

Year ending March 31, 1878, number of hens, 60; eggs laid, 4,377; sold, $317\frac{1}{3}$ dozen, at 21 cts., \$66.59; fowls sold, 171, at $42\frac{1}{2}$ cts., \$72.72; total income, \$139.31; expense, \$37.15; profit, \$102.16; the average number of hens, $35\frac{1}{3}$; average eggs per hen, 121; net profit per hen, \$2.90.

Year ending March 31, 1879, 54 hens; eggs laid, 4,269; sold, $291\frac{3}{4}$ dozen, at $23\frac{1}{2}$ cts., \$68.71; fowls sold, 294 at 44 cts., \$129.02; total income, \$171.73; expense, \$40.82; profit, \$156.91.

Year ending March 31, 1880, 65 hens, eggs, 5,257; sold, $393\frac{1}{3}$ dozen, at $22\frac{1}{3}$ cts., \$88.45; fowls sold, 177 at $46\frac{2}{3}$ cts., \$82.75; total income, \$191.20; expense, \$27.75; profit, \$143.45.

Year ending March 31, 1881, 64 hens; eggs laid, 5,566; sold, $423\frac{2}{3}$ dozen, at 24 cts, \$101.68; fowls sold, 139 at $43\frac{2}{5}$ cts., \$58.98; income, \$160.66; expense, \$32.60; profit, \$128.06; average number of hens, 48, 116 eggs each; profit per hen, \$2.66.

### METHOD OF KEEPING ACCOUNT OF SITTING HENS.

| Date. | Number of Hen. | Number of Eggs set. | Number of Chicks hatched | Number of Chicks died. | Memoranda. |
|---|---|---|---|---|---|
| March 20, .......... | 1 | 13 | 4 | 3 | Too cold. |
| " 20, .......... | 2 | 13 | 2 | 1 | " " |
| April 1, .......... | 3 | 11 | 8 | 2 | |
| May 8, .......... | 4 | 11 | 9 | 0 | Plymouth Rocks. |
| .......... | 5 | 13 | 6 | 1 | 7 eggs addled. |
| , .......... | 6 | 13 | 10 | . | White Leghorn. |
| , .......... | 7 | 9 | 9 | . | Old Fluff stole her nest. |

### POULTRY ACCOUNT FOR YEAR ENDING MARCH 31, 1879.

We will give now a summary of one year's work, showing the method used to ascertain the profit.

| | | |
|---|---|---|
| April 1, 1878, Number of hens, 54, at $1.00 each, - | | $54.00 |
| " " cocks, 5, " " " - | | 5.00 |
| Whole number of eggs laid, 4,269, $355\frac{3}{4}$ dozen, at $21\frac{1}{2}$ cts., - - - | | 76.49 |
| " " for family, $97\frac{1}{4}$ dozen+$14\frac{1}{2}$ dozen given away, - - - - | | 23.66 |
| " " for sitting, 768, 64 dozen, - - | | 13.76 |
| " " chickens hatched, 492, - - | | |
| " " died, 65 + 98, 163, [cholera " " " from drain.] - - | | |
| " " " raised, 329, - - - | | |
| " " " sold, 200, at $35\frac{1}{4}$ cts., | $70.50 | |
| " " " " 13 [stock] for | 18.00— | 86.66 |
| " " " given away, 7 young chickens, $2.40 +old fowl, - | | 2.82 |
| " " " for table, 34 at $35\frac{1}{4}$ cts., - | | 11.98 |
| " " old fowls, for table, 17 at 50 cts., - | | 8.50 |
| " " " " sold, 15 at $58\frac{2}{5}$ cts., - - | | 8.76 |
| Total value eggs and fowls for our family use, | $49.35 | |
| " " " " " cash to owner, | 37.31— | 86.66 |
| To brother's family, eggs, 876, 47 dozen, at $21\frac{1}{2}$ cts., $10.10+26 dozen at $27\frac{1}{2}$ cts., - | | 17.45 |
| old fowls, 7 at 50 cts., - - | | 3.50 |
| young fowls, 14 at $35\frac{1}{4}$ cts., - | | 4.94 |
| cash on sales, - - - | | 19.73 |
| total to H. R., - | $45.62 | |
| Grain from Chaffee & Co., $20.70, | | |
| " " farm estimate, 20.12,—$40.82 expense of food. | | |
| Interest on stock at 5 per cent., - - | $ 2.95— | $43.77 |
| Value of eggs for family and market, | 68.71 | |
| " " fowls " " " " - - | 129.02 | |
| " " " added to stock, 9, - - | 9.00 | |
| " " five loads manure, - - - | 25.00— | 231.73 |
| Balance profit, - - - | | $187.97 |
| Profit per each hen, - - - | $3.48 | |

METHOD OF KEEPING DAILY ACCOUNT.

65 HENS—3 COCKS.

| | | | |
|---|---|---|---|
| April | 1, | 37 | Eggs laid. |
| " | 2, | 29 | " " |
| " | 3, | 42 | " " |
| " | 4, | 32 | " " |
| " | 5, | 34, | 44 Eggs to H. R. |
| " | 6, | 30 | |
| " | 7, | 39, | 17 |
| | | 898 | Total for month. |
| | | 224 | Total to H. R. |

EGGS SOLD.

| | |
|---|---|
| April 3, Mrs. Smith, 1 doz. at 25c,.... | $ .25 |
| " 10, Mrs. Jones, 4 doz. at 25c,.... | 1.00 |
| " 21, Platt & Green, 10 doz. at 28c, | 2.80 |

CHICKENS SOLD.

| | |
|---|---|
| June 1, Mr. Brown, 1 young cock,... | $ .50 |
| " 10, N. Y. market, 25 young cocks, 2 lbs. each, at 22c. per lb., ... | 11.00 |
| Less $1, freight and com.,... | 10.00 |

Hints concerning the proper care of ducks, geese, turkeys, and other varieties of domestic fowl, we leave to those who have had more experience. Also the best modes of treatment for those special diseases that cause so much annual loss to those who keep the choice flocks of pure breeds.

The question still comes echoing back to us—does all this labor pay? We answer, this depends upon the value we put upon our labor, and our reasons for undertaking it. For ourselves we have two main motives in this employment. The first is, we must have eggs and chickens, and have them in abundance, and have them when they are scarce in the market, and the only way we have yet found to procure them is to raise them ourselves.

We have tried to train up an assistant who should know just our way of doing things, and who should be able to take entire charge of the flock, and so relieve us of care and labor for a season, but although we can find helpers who will follow directions and obey orders in the minutest details, we have so far failed to train one to have such an amount of good judgment that he could be trusted to guard against and prevent the many accidents that would arise from the want of such attention to unforeseen occurrences.

Another strong motive for our work is the change it brings from domestic duties, which must be so almost wholly performed within doors. The very frequent occasions for going to the chicken coops, or to the hennery, give us an amount of fresh air, especially during the winter season, that possibly we would think we could not spend time to get in a morning or evening constitutional.

One other reason for our interest and patience with our feathered family, is that this branch of our home farm operations is committed entirely to our care, and we desire to make it as profitable as any of the other departments that are in the hands of our brothers.

Mr. ANDREWS of Rockville. I notice that the lady gives directions how to feed chickens. I know parties who make a practice of mixing different kinds of grain and keeping it where the fowls can get it whenever they want it.

Miss REED. I think, if the fowls are in confinement, they would eat too much, and be too fat.

QUESTION. Do you make a practice of feeding sparingly, so that there is nothing left after each feed?

Miss REED. It depends upon circumstances. If I wish to be gone a day, I throw them enough in the morning to last until I get home. I give them a little corn on the cob. If they are hungry enough to pick it off of the cob, it will not hurt them. But if given shelled corn, any ordinary hen will eat too much.

Mr. MAYNARD of Rockville. It occurs to me to ask about heating the poultry-house in the winter. What has been your custom about artificial heat?

Miss REED. I have no artificial heat at present. I did have it for a very short time, when the house was new. It was built late in the season, and the floor became very wet—too wet to be used with safety—and my father put in a stove, exciting the laughter of some of the neighbors and the good wishes of some others. I think it was an advantage, but it was too much work to tend the fire, and we did not feel that it was quite safe. The house was not built with sufficient safeguards against fire to allow us to use a stove. But I think if a house was properly built, and one was going into the business to make money, the true way would be to have artificial heat.

Mr. TILLINGHAST of Berlin Depot. I would like to inquire the most economical way of supplying fowls in winter with green food, and whether ensilage has ever been used for that purpose.

Miss REED. I have never used ensilage. The only green food we have used has been cabbage and apple-skins. They are always supplied with an abundance of hay. I should be very glad to hear if any of the gentlemen have used ensilage.

Mr. BARNARD of Bristol. I would say that I have, since the snow came on the ground this winter, thrown ensilage to my hens, and they seem to like it very much. As to the results, I cannot say.

Mr. GEO. LASBURY of East Windsor. I find that my hens eat very greedily all the crockery that is broken around the house, and I find that it helps their laying qualities. Oyster-shells, clam-shells, and more particularly bones, are valuable. Take all the bones that you can find around the house and crack them up; your hens will eat them greedily, and it repays the cost in time and trouble.

The lady has told us to "prove all things." Nothing has been said about the value of the manure. In keeping hens, I look upon the manure as almost of as much consequence as the eggs. I take out from twenty-five to thirty bushels of manure from under my hens every year. I take one bushel of hen manure and one bushel of plaster, and run the mixture through my coal-sifter (I want to keep it dry), and if you can find anything better than that to put into corn-hills, you can do more than I can. Put a handful into your corn-hills, and you will see your corn come up wonderfully. In order to save this manure of course you must have your hens roost in one place. If they roost here and there, and all around, of course you cannot save it; but if they roost in one place, then you can get the manure, and use it to great advantage on almost anything except potatoes. Hens do well in the winter season if they are supplied with broken crockery, cracked oyster-shells or clam-shells, and crushed bones. That is a very particular point.

Mr. TILLINGHAST. I will give my experience in feeding green food to hens. I have found nothing better than mangold-wurtzels. I have raised them two or three years, and I find that my hens devour them very greedily; and I find that the egg-baskets tell as soon as they are fed. I find that if they are omitted the egg-basket is much lighter. I would inquire whether meat is a necessity for laying fowls?

Miss REED. No, sir; I do not think it is actually necessary, but I think it helps very much.

Mr. TILLINGHAST. Last winter, I fed no meat, but I fed plentifully of these mangolds, and I found that my hens laid as well as I could expect them to do in the summer, even, when everything was favorable. I keep cracked bones and oyster-shells where they can have access to them at any time. I would like to inquire in what condition the hay is given to the hens—whether dry or wet?

Miss REED. It is dry, just as taken from the mow. Clover hay is preferable.

Mr. ——. Without cutting?

Miss REED. Without cutting; yes, sir. They cut it for themselves. I often go to the barn with a corn-basket and scrape up a whole basketfull of leaves and seed, that is not good for feeding cattle, and throw it in one corner of the hen-house, and they are very eager to scratch it over. That, too, gives them employment.

Mr. HOLLAND of Willimantic. A gentleman asked, a few moments ago, how green forage could be kept in winter. I have dug a pit nine feet and a half deep in a side hill, laid some small stones in the bottom and covered them with cement, and cemented the upper side in the same way. In the summer time I cut some of my grass when it is about six inches high and put it in there, press it down solid, roll large stones on top of it, and in that way I manage to keep it for winter so that it is as nice and green as if just cut.

In reference to hen manure, I will say that it is of the greatest importance in poultry-raising to save the manure. I know one gentleman, who is a large poultry-raiser, who gets six hundred dollars a year for the manure. I only keep a few hens—anywhere from seventy-five to two hundred—but last year I sold twenty dollars' worth. The farmers are all ready to buy it at $1.50 a barrel.

Miss REED. I did not mean to leave the impression that the manure had no value. It is so valuable that none of it is sold; it is all used on the farm. It is very carefully preserved and used on corn, or any poor field of grass, that requires something extra. My father values it very highly; but it would not do to put it on the book exactly.

Mr. Gold. Some questions from the Question Box have already been propounded and answered, but there is one here that perhaps some gentleman can answer: "Are Incubators a success?"

Mr. Holland. I can say a word or two on that, but not from practical experience. A gentleman with whom I am acquainted at Mt. Washington, Md., had 4,661 chickens in the month of February last, and raised 3,980 of them. Mr. Hawkins of Lancaster, Mass., raised 3,000 in one year. He used the Parker Incubator for a time, but he found it too much trouble; it had to be attended to every two hours. He substituted the Yardley Incubator, which requires attention only once in twelve hours.

Mr. Albert Day, of Brooklyn. I am unwilling to let this occasion pass without expressing my great gratification at the ability of the paper that the lady has submitted to this meeting, and congratulating the Secretary of our board that he has been able to procure such a paper. I don't know that it is necessary to compliment him, but I have thought for a long time that he was quite a remarkable man, and very fertile in the presentation of topics for discussion at our meetings. He has presented a good bill of fare year after year, and the last is the best, so far. I believe, Mr. Chairman, that this is the first occasion on which a lady has addressed a meeting of our Board of Agriculture, and I will say, in the honesty of my heart, that I welcome her, and I welcome the able and practical address that she has made.

It used to be said, "Cotton is King," but after a time that was disputed, and it was claimed that corn was king. Now, I am not going to put fowls in the same category with cotton and corn, but when we consider the immense amount of money that is invested in fowls and their products, we shall all recognize the fact that it is certainly one of the most important industries that we have, and, I think, one of the most neglected. And for this reason I hope that the Secretary will, in the fertility of his genius, introduce more ladies to speak before our board, and if they are as entertaining and instructive as the lady whom we have had the pleasure of

hearing this afternoon, I am sure we shall accord them the same hearty welcome that we do Miss Reed.

Dr. RIGGS, of Hartford. In view of the importance of this question, I will relate something of my experience, many years since, in regard to the feeding of young chickens. I found that corn, in any of its shapes or forms, either whole or in the form of meal, was the most pernicious food that could be given, as a whole diet, for fowls or for chickens; and the best food was oat meal, with milk that was curdled. I never saw any harm from these things when mixed together and fed to young chickens or to fowls, but they grew beyond all account. Corn, in any shape, fed to a young animal, whether it be a pig, a calf, a chicken, or any young animal, is too heating, and you will invariably have trouble from it, that you know not how to account for. You can give oat meal; wheat screenings, ground up, or oat meal, with a little of what is called the middlings of wheat, and as they grow a little larger you can give a little ground buckwheat mixed with it; but oat meal, for young chicks, a day or two after they come out of the shell, when they begin to eat, mixed with a little milk that is curdled, makes the finest food that can possibly be given.

Ensilage is inquired about. I know not what the practice is in this country, but in foreign countries they make great use of ensilage as food for hens. They will eat it very greedily, especially if it be young grass, as one gentleman in the audience has stated. It is preserved on the same principle, almost, as the Germans preserve their cabbage, for making sour crout for their own table, only I think that it is a little better for cattle than sour crout is for any people but the Germans. The taste for it requires cultivation, and I think the Yankee nation would really get to like it if they would begin to eat it; but it is altogether too odorous for our modern civilization.

There is one point on which I am not quite clear, in regard to which I would ask the speaker to give an explanation. She has described a certain type of fowls as the standard for

eggs, and at the same time she speaks of using Buff Cochin, Leghorn, and Plymouth Rock cockerels. How does she maintain that standard, in using different breeds?

Miss Reed. We have had no Cochins. We bought two sittings, but none of the eggs hatched. They were total failures. We have had a Plymouth Rock and a Leghorn, but the intervals have been so long that the special peculiarities of the breeds have been bred out. We select only those which conform to our own standard. We have two distinct breeds at present. We have the white, which is more Leghorn than Brahma, and we have the speckled, which is like the Dominique and Plymouth Rock. They are entirely distinct, and we keep them distinct. But it is too much trouble for persons who cannot devote their whole time to the matter to keep more than one breed of fowls. Somebody will leave a door or a gate open, or some child will look in to see how they are getting along, and they will all get together, so that you will have a world of trouble. We therefore keep only two breeds, and probably shall keep but one when we have decided which is best.

Question. Do you advocate giving chickens water or milk, or any liquid, before they are six weeks old? There has been a good deal of controversy in poultry papers on that point. I have raised chickens for the last two years without giving them any liquid at all until they were six weeks old, and I think they have done as well or better than chickens that have had liquids earlier.

Miss Reed. We have always practiced giving them water as soon as they would drink it. Perhaps the food you gave them was such that they did not require water. But if they were fed with dry food, I think they would be thirsty. My chickens always cry for water. It is a peculiar cry, different from the cry for food. If you give them food when the water trough is empty, they will give that cry. Give them water, and they will be satisfied.

Mr. ——. Mr. Hawkins raised 10,000 chickens the past season. For the last four years, his practice has been to give them no water until they were six weeks old.

QUESTION. What is the objection to water?

Mr. ——. He thinks they grow faster without it. He thinks water gives them the diarrhœa, and that they are less likely to catch cold than if they had water.

Miss REED. Perhaps we could all learn to go without water.

Mr. TILLINGHAST. My practice is to keep water from them until they are a month or six weeks old. What few chickens I have raised this year I have raised without giving them any water, and I have had better success than when they had water.

Miss REED. Has anybody used a bone mill, and what does it cost?

Mr. ——. A mill for grinding bones can be furnished for $45.00.

Mr. ——. I have a hand mill for grinding dry bones that cost five dollars.

Mr. LASBURY. Coarse wheat bran, wheat shorts, mixed with hot water, and a little pepper put into it, can be fed to fowls, and they can eat all they want without hurting them.

Mr. FOWLER. I take the bran the gentleman speaks of, mix it with mashed potatoes, and give it to my fowls hot. I give them grain first, but give them this as a second breakfast. And then I take green bones, that I buy in the market at a cent a pound, and pound them up fine. I find there is nothing that will make hens lay so well as giving them bones and wheat screenings; but of late I cannot buy wheat screenings. It is claimed that it is cheaper to bring wheat here instead of the screenings. But I claim that wheat screenings are better for fowls than whole wheat.

Mr. ——. I would like to inquire of the gentleman if he has ever found any difficulty in the use of western wheat screenings from any poisonous substance in them?

Mr. FOWLER. You find in some wheat screenings a peculiar seed, somewhat resembling onion seed, which is the seed of cockle. I am very careful not to buy any wheat screenings which has this seed in it. It makes a great many

weeds around the house, that is the only difficulty. I have never found any difficulty about poisoning.

Now that I am up, I will ask, do you think that onions do any hurt? I have heard that onions were a healthy article of food for hens. I this year raised quite a piece of scullions, and pulled two cart-loads for the purpose of feeding them to my hens this winter; but I heard one person say, while in Hartford, that they bought eggs from Wethersfield (that is a great onion town, you know), and they tasted so strongly of onions that they were objectionable.

Miss Reed. We have used onions very sparingly, not having them very plenty, and being very fond of them ourselves. I think a few onions may be fed with advantage, but any great number would affect the taste of the eggs; I have no doubt of it, although I do not speak from experience.

Mr. Fowler. I have heard it claimed that feeding onions kept away vermin, but I do not know whether it is so or not.

Miss Reed. Kerosene will do that.

Mr. ——. The lady, I suppose, has let her hens run at large. I would ask if hens in confinement can be made to lay equally as well as those that have an opportunity to run at large?

Miss Reed. We are obliged to keep ours shut up entirely when there is snow on the ground; we have had our hens shut up for three weeks this fall, and now that snow has come again, they have a prospect of three months of confinement. As long as snow is on the ground, there is no other place for them. They are not allowed to go near the barn or pig pen, or any place but their own quarters. But I was going to say, in regard to western screenings, that my father objects to that, on account of the seed it brings on the farm. He says we better give them the best of wheat rather than buy screenings.

Mr. ——. I would say that my experience is, that hens in confinement will do fully as well as those at large, provided their wants are well supplied. If they have everything that is necessary to their comfort, they will lay as well when confined as when they have full liberty.

Miss Reed. I would like to ask what is meant by "confinement"? Does the gentleman mean that the hens are kept in a building or in a yard? And if in a yard, is it a limited yard or a large yard?

Mr. ——. They had a run, but were not allowed the liberty of the farm. I think milk has been spoken of as a diet for hens. I have not found anything better than milk, fed with wheat bran or middlings.

Mr. Augur. There is one subject to which I would like to allude in connection with this matter of poultry keeping; and it seems to me, from what I know of the practice of farmers generally, that it is a subject to which reference should be made. We have in Middlefield a gentleman who is very successful in managing poultry, and two years ago he told me that he made a strong point of this (I think Miss Reed has touched upon it): when the weather is cold, he does not allow his hens to go out and get chilled. He thinks that when the thermometer is below zero, or even near zero, if fowls are allowed to range outside in search of food, it is a great hindrance to their laying. Consequently, he is very careful to keep them, in cold weather, where they will be warm and comfortable.

Mr. Allen. I have been exceedingly interested in this discussion, and I have learned a great deal about this hen business; one thing I have learned is, that there are some people in the State of Connecticut who *do feed their hens*! That is news to me. In the vicinity where I live, nobody ever thought of such a thing, that I know of. I am sure my neighbors never did, or of feeding their turkeys either; why, there have been about forty or fifty turkeys roaming over my farm all summer. I am sure the proprietor never thought of feeding them; and his hens are all around me, in every direction. Our whole community, as far as I know, would be very much surprised, if they were present in this Convention, to hear that anybody took so much pains as to feed their fowls. Is it a fact, sir, that this lady gives her time and attention to her fowls, feeding them, housing them, and

caring for them in the way she has described, and that these gentlemen who have spoken do the same thing? And is it a fact that they find pleasure and profit in doing it? I hope that lecture will be strewn broadcast over this community, and go into every household with the discussion which has been had upon this subject, so that people may know that there are some folks who *do* feed their fowls and take care of them. My experience is that there is not another so great a nuisance in the State of Connecticut as the hen, and if anything in the world can be done to enlighten the people on this subject, and make them take care of their fowls, I shall be very glad of it, and I am sure the people of the State of Connecticut will pass a vote of thanks to Miss Reed and to this convention if anything of that sort can be accomplished by this meeting.

Mr. Webb. I see the gentleman has caught it hard! I caught it myself several years ago, and had it until my wife cured me of it. I sowed a piece of turnips one year, manured it heavily, took a great deal of pains with it, and thought I was going to have a heavy crop of Swedish turnips. We had some turkeys, and I wanted to kill the turkeys, and to kill all the hens, too. My wife, however, persuaded me to keep them all. Well, I made up my mind that she might have her way that time, and I would trust the turnips. She went on, and that fall, when she came to close her accounts, she had sold about two hundred and sixty dollars' worth of poultry, and we had more than we started with left, and I had lost at least five bushels of turnips, worth twenty cents a bushel!

This question of poultry raising is a very important one, if we will attend to it properly. Everybody cannot make it a specialty; but every farmer can embody that as part of his business, and can make money at it, by giving it care. It is like every other department of business.

Now, I have neighbors all around me, and they keep hens. I used to keep myself in a fret all the time about my neighbors' chickens, and sit up nights to think about them; but

since the time to which I have referred I have not worried about them at all. They take but little, and they kill more worms than they pull turnips. They do no harm to my crops, and they are a source of profit to me and my neighbors. It is a very important part of agriculture, and if we will give it attention, and lay aside our prejudices, we can profit by it.

I have been thinking of what Mr. Day said in regard to this lecture. It is the first one we have had from a lady, and she has shown us how we can make money enough to go and hear Neillson, or Patti, or any of the great singers who are traveling about the country, and we want to go and hear them sing, and see distinguished people, and all that sort of thing. She has my thanks, and I have no doubt she has the thanks of all present.

Mr. Armstead, of East Hartford. In view of the importance of this subject, as developed in this discussion, I would like to ask Prof. Armsby if this branch is taught in the Agricultural School?

Dr. Armsby. It is a part of the Agricultural School. I cannot say that it is taught there.

Mr. ——. A gentleman was speaking just now about feeding poultry. I stopped one day at a gentleman's place who had a large flock of hens, and I spoke of the fact to him. "Yes," he said, "I have. How much do you suppose it has cost me to feed them this summer?" "I don't know," I replied. "Well," said he, "it has not cost me a cent." (It was along in August sometime.) "How do you make that out?" "Oh," said he, "there is a gentleman who has four acres of potatoes near by." That was the first year the Colorado beetles came round.

Mr. Allen. Perhaps the gentleman thinks I am one of those outlandish men who do not feed their poultry. I do not know how many people there are in my vicinity who do not feed them, but I feed and take good care of mine, and it is a pleasure to do it. It is not because I am nervous about my own poultry; they do not trouble my neighbors. I am breeding white Leghorns, and keep them away from other hens.

They are a source of pleasure to me; I like to have them around. But when I sow five or six acres of buckwheat, and have a good crop, and find, when I go into the field to harvest it, that my neighbors' turkeys have harvested it for me, I do not feel in a very pleasant frame of mind. And when I set out two acres of cabbage, manure them well, and expect to have a great crop, and find my neighbors' turkeys have eaten them all off, I do not feel so pleasantly about it. I don't know but my friend Webb can keep his temper under such circumstances, and keep perfectly calm, but I can't.

Mr. WEBB. I don't have the same temptation, perhaps. I don't raise buckwheat for my neighbors' turkeys to prey upon. That is the difference.

Mr. FENN. There is one branch of this subject that has not been discussed, and that is the way of selling eggs. There has been a good deal said about selling them by weight. I would like to know if the lady has taken that matter into consideration?

Miss REED. I think eggs should be sold by weight. They are so sold in Denver, Colorado, as well as vegetables and many other things which we do not sell by weight.

Mr. FENN. The only information which I have been able to gather on that point has been by reading a discussion in a New York Farmers' Club which was printed in the *New York Times*. The conclusion which was reached was that a pound and four ounces was the average weight of a dozen eggs. In order to test the matter, I weighed a dozen eggs from my hens, and found that they weighed a pound and eleven ounces. During the season, I weighed several lots of eggs, and found none that weighed less than a pound and six ounces per dozen.

QUESTION. What kind of hens?

Mr. FENN. Mixed; no particular breed.

Mr. GOLD. A question has been handed to me. Is there any objection to feeding oats whole to fowls?

Miss REED. We feed oats whole, and would feed a good

many more, if we raised more oats. The trouble is to get the oats.

QUESTION. Have you ever found any evil effect from feeding oats.

Miss REED. I have never found any difficulty in feeding oats, except occasionally I have found a chicken that got choked by them; or, I should say, the chicken would have choked if some one had not been at hand to get them out of its throat.

Mr. ——. I have found barley to be far ahead of oats as a feed for poultry. I have raised it for that purpose.

Miss REED. I would like to inquire if any one has had any experience in feeding parched grain of any kind?

QUESTION. Has any one had any experience in feeding apples to hens?

Mr. ——. I have had a limited experience. They devour sweet apples very greedily, and I find that hens that are supplied with apples lay better than other hens that have an unlimited range of the same feed, excepting apples.

Mr. ——. Whenever I feed oats, I always feed them parched. I put them right into the oven in my house. It does not cost any more to feed pure-blooded fowls than it does a mixture, and they look much prettier than mixed breeds.

The PRESIDENT. If Dr. Sturtevant is in the house we would be glad to hear from him.

Dr. STURTEVANT. There is so much that I could say, suggested to me by what I have heard this afternoon, that I hardly know how to begin; and yet I feel that I had better make a few rambling remarks upon several subjects than attempt to speak upon any one special topic.

And first I will make a remark suggested by the discussion on poultry. Poultry raising is a small affair, but did it ever occur to you that it is the littles in this world which are of the greatest consequence? We find no strata built up of the bones of the gigantic mastodon, but some of our great rock strata are built up of the remains of the most minute in-

fusorial beings. Therefore, it is not the size of a subject that determines its importance, so much as its bearings upon other subjects with which all the world has to deal—the *littles*. And so, in all experimental work pertaining to agriculture, we have to deal with the *littles*, and until those *littles* are determined it is almost impossible to get at a true understanding of results we are willing to call great.

Since I had the pleasure of meeting this board the last time, I have had to change my method of talking a great deal. I find that I now have to draw a line, and keep that line clearly marked both before myself and the public; and that line is between what I *know*, and the *inferences* which I draw from that knowledge. I have found it necessary, during the last year, to change the opinions which I had formerly assumed to be correct, and to change so many times that now it is as easy for me to change my mind as to turn over in bed.

I was requested on my way toward the platform to make a few remarks in connection with the fertilizer question, experimentally. Now, those who may be acquainted with my past know that I have paid some attention to fertilizers, but in going upon the farm of the New York Experiment Station, I felt as if I had not sufficient knowledge to justify prompt experiments upon the land, and thus we have expended our appropriation for one year, twenty thousand dollars, without having tried one single direct experiment with fertilizers. Whatever we have learned in regard to fertilizers has been incidental. I speak of this because I want the audience to know how I feel about it, and how I think they ought to look upon their own Agricultural School and Agricultural Experiment Station, and see how easy it is to cry for agricultural experiments with fertilizers, and yet how difficult it is to make them. If I had time, I could read you record upon record of experiments which would show the futility of the experiments rather than the value of the fertilizer applied. I will take time to give one, and I will use the blackboard to illustrate.

There are ten plats of corn, on one-tenth of an acre, each plat planted at the same time, and under equivalent circumstances. There were various quantities of fertilizers applied. None on the first plat; then 200 pounds, 400 pounds, 800 pounds, 1,600 pounds. The corn was treated alike in every respect save one. A line was drawn through the center, and the lower half received cultivation and the upper half received no cultivation. Now, gentlemen, if I said that in eight cases out of ten the uncultivated plats produced more corn than the cultivated, you would not believe it; if I stated the opposite, you certainly would believe it. But the fact was, that eight of those ten plats showed that cultivation decreased the amount of corn, and two of them only showed a little in favor of cultivation. And yet, because that is counter to our opinion, we would not be willing to accept that experiment. If it proved just the opposite, that cultivation was beneficial, we would not question the result from so many plats all showing the same thing.

Fortunately, in this case, I had another series of plats, exactly the same, half of which were cultivated and half uncultivated; and in this case, in every single instance, the cultivation showed great benefit.

Now, that series of experiments with forty plats teaches us absolutely nothing in regard to cultivation, but it does teach us the caution required in carrying out experiments, and caution in regard to generalizing on insufficient data. And our experiments with fertilizers comes under this same category.

QUESTION. What is your opinion as to the cause of the difference?

Dr. STURTEVANT. I have none at all.

QUESTION. Was all the corn planted alike as to depth?

Dr. STURTEVANT. Precisely alike. You must remember that these experiments were carried on with the amplest resources. The depth of planting, and everything connected with them, was carried out exactly according to the plan. I should horrify you if I gave you the details of the expense. The lines were run by a transit, the seed dropped, when

required, by a gauge, covered exactly alike, everything done that could be done to get results precisely alike,—just what ample means will allow to be done.

QUESTION. Was the soil alike as to moisture?

Dr. STURTEVANT. As far as the eye or common observation could detect, but absolutely, not. Instruments would undoubtedly detect a variation between any two places.

Now I am coming to the point which interests me the most, and which I think ought to interest every farmer,—the value of a man. If a hole is to be filled, one man will fill it as well as another; it is a mere question of avoirdupois; but when we come to higher uses we have got to select, and we find fewer men who are capable of meeting the demand. In other words, education tells more and more as our studies become more complicated. As agriculture becomes more difficult, it becomes essential that we have more education. In agriculture, education is the lever which is going to move the farm much more in the future than in the past, and we want to further the education of the farmer in every way we can. We want not only the farm-boy educated, but the farm-man himself.

Now, there are many subjects which at first thought seem abstruse, and far away from any practical agricultural application; and yet, my experience has been such, that I believe there is scarcely a well-defined scientific investigation connected with agriculture that will not be found, sooner or later, to have practical uses. The slur has been cast upon botany, that it has not any practical use in agriculture. I have known some skilled botanists to be puzzled when asked of what use botany could be in agriculture. They had no answer ready to their minds. I propose to take a few moments to illustrate the connection of botany with agriculture. Bear in mind that I am speaking of two things,—one is, facts; the other, the inferences from the facts. The facts cannot be questioned; the inferences may be; and here each one is justifiable in judging for himself.

Agricultural botany has been but little studied, and if, per-

chance, some botanist should be present, he will undoubtedly notice that I give expression to some things which botanists do not teach; in fact, they teach precisely the opposite.

Corn belongs to the monocotyledonous order; that is, it has only one cotyledon; and that order, according to the botanists, has no tap-root. And yet, if you take a kernel of corn, you will find that there comes from the chit the small caulicle which extends upward into the plumule and downwards into a radicle, and this last goes down into the soil, proving a distinct tap-root. At the same time, roots start out at the junction of the plumule and pass into the soil, while the tap-root throws out a mass of little fibers in both directions.

I think I have made plain to you by the blackboard simply the germination of the corn, and now it will be my object to show how it has a bearing upon agriculture. I have dug up corn plants repeatedly, and have invariably found certain appearances. Let me tell you what digging up a corn plant means. It means, first, digging a trench, deeper than the roots extend, alongside of the plant; it then means taking a powerful garden engine, having one man at the pump and another at the hose, working by the hour, yes, by the day, in washing out the soil, until the roots are left suspended in the air, in just the position they occupied in the soil, so that you can trace each root back to the plant, and you do not confound the roots of anything else with those you are investigating. So you see by that method we have the means of getting at facts.

Now, there was a very pleasant little occurrence in October at the Experiment Station at Geneva. Dr. Gilbert, of England—who, you know, is the associate of Mr. Lawes, and one of the most accomplished scientific agriculturists in the world—was visiting me, and I had holes dug to allow him to investigate the soil; and, among other things, I had a hole dug in a cornfield in order to call his attention to the arrangement of the roots. He heard the suggestion that I made, and accepted it immediately, saying that he thought it was perfectly reasonable, and that it had a strong practical applica-

tion. He said (adding somewhat to what I thought I had discovered) that it accounted for the corn crop being, in a great many cases, a renovating crop, and also accounted for the fact that it seemed to require, in practice, less of certain fertilizing elements than theory would indicate.

Now, if you dig up a corn plant, you will find a series of roots extending in every direction through the soil. I have only been able to trace those roots about two and a half feet from the plant, on account of the intersection of the roots of other plants: but by applying fertilizers at varying distances, and seeing how far they affect the plant, I find that fertilizers applied at a distance of ten or twelve feet from the corn plant influence the growth of the plant distinctly and visibly.

Now, these roots seem to be governed (I use the word *seem*, because this is a difficult question to determine)—*seem* to be governed in their extension and in their feeding power by the temperature of the soil. It seems, (and this is a case for argument, and perhaps contradiction)—it seems to be a fact, that unless the temperature in summer is sufficient for the fullest extension of these roots, the application of the fertilizers does not have any marked effect upon the crop. So that not only the fertility of the soil, but the temperature of the upper layers of the soil, is an important factor in the production of the crop, and the two conditions seem to have important relations to each other.

Now, a good many of these facts are inferential that I am giving you now, rather than absolute. We were not able to determine with accuracy the ranges of temperature, as our instruments were insufficient; yet as all the indications pointed in one direction I feel justified, with this qualification, in calling your attention to them.

Now, from this corn plant passes down this tap root, which I indicate on the blackboard, and which I have drawn here in showing the germination of the seed, contrary to the rule of the order to which the corn plant belongs, and contrary to the statements of the books. I called the attention of Dr.

Gilbert to that tap root, as being the provision by which water is supplied to the plant, while its other roots are occupied with feeding the plant. His remark was, "Yes, and also for supplying nitrogen to the plant; and that," says he, "is the explanation of the fact that the corn plant, under some circumstances, is a renovating plant, and can be grown without rotation for a long period."

If these things are true which I am stating to you (and I think I have stated them so clearly that you can see where fact ends and inference commences), in our manuring for corn, the object must be to put the fertilizers in that region which is occupied by these roots; in other words, in the region of high temperature. There has been a far different season in New York this year from that which you have had in Massachusetts. It was the coolest summer I have ever experienced during my life. There was but one evening during the summer when it was comfortable for me to sit on the piazza without an overcoat. Every night but one I slept under blankets, and the thermometer showed a low maximum temperature of the soil during the season of the growth of the summer plants. Under these circumstances, these feeding or upper roots which I have described passed but four inches into the soil. In other words, my corn plants this year fed upon the upper surface of the soil; and as nearly as we could estimate the relation of the upper roots to these lower roots, it was about as one thousand to one.

Mr. Sedgwick. Did you see any difference between the plats where the fertilizers were applied and those where none were applied?

Dr. Sturtevant. The question was as to the influence of cultivation, and the relation of cultivation to the amount of fertilizers applied. My remarks had no reference to the influence of fertilizers.

Mr. Sedgwick. Was there any difference in that respect?

Dr. Sturtevant. I do not want to talk upon that subject, but if it is pressed upon me, I have no secrets. The fact is, that you could trace the influence of the fertilizers in a direct

ratio to the quantity applied, up to a certain point. Here is nothing; 200 pounds; 400 pounds; 800 pounds; 1600 pounds. You could walk along and see the indications of the effect of the fertilizers on the corn, according to the amounts applied. But when we came to the crop, we had no indication that any fertilizer or barn-yard manure was of the slightest use upon corn or potatoes this year.

QUESTION. Did you analyze the fertilizer, to see whether it was good for anything?

Dr. STURTEVANT. Everything used was good. The barn-yard manure and all were good.

Mr. AUGUR. Was the ground on the same grade?

Dr. STURTEVANT. A very gentle slope. It may have fallen two or three feet from the highest to the lowest point. It was kept free from weeds by chopping them off with a hoe. The result is, that these two experiments balance each other. If I had had but one of these series, the one which resulted in favor of cultivation, I should have said that those twenty plots were sufficient to settle the point in favor of cultivation; but as I happened to figure on the other series first, and found the results against cultivation, I was not willing to believe it; that is all.

QUESTION. I would like to inquire whether the fertilizer was spread on top or plowed in? and also, whether we are to understand that the cultivated ground was hoed, or the cultivator run through it, and the uncultivated portion was not touched?

Dr. STURTEVANT. The uncultivated portion means that the weeds were kept down by pulling or with the hoe, without disturbing the soil. The cultivation means hoeing and the use of the cultivator, as a good farmer would do in ordinary practice. The fertilizers were applied in all ways, nearly; on the surface, under the surface, and in the drill.

QUESTION. Would you have us understand that you got more corn by not cultivating?

Dr. STURTEVANT. No, sir. I would have you understand that in one case we got more, and in the other we got less,

and they balance each other, showing the difficulty of carrying on such experiments. In other words, the experiments do not tell us any-thing, when we figure on yield of plats.

QUESTION. Did you have an average amount of rain?

Dr. STURTEVANT. I am not able to say as to that, but we had no drought. We had local showers, which protected us.

QUESTION. Did you not at one time favor root-pruning for the corn plant?

Dr. STURTEVANT. Yes, sir.

QUESTION. What is your opinion now on that?

Dr. STURTEVANT. I am not here to give opinions. I will give you experiments, and my own inferences from them, if you like, but I have given up having opinions.

Dr. RIGGS. Did you observe any difference in the leaves of the corn as it was growing? whether they wilted after the cultivation, or whether they were like the other portions of the field that were not cultivated?

Dr. STURTEVANT. Corn with me only wilted one day during the whole season, under any kind of treatment except the most excessive root-pruning.

Dr. RIGGS. I refer simply to the effect of cultivation?

Dr. STURTEVANT. No, sir: it did not cause the plants to droop.

QUESTION. Were the two sections that were cultivated both cultivated on the same day, so that the effect of the day or of the state of the soil at the time would be the same on both sections?

Dr. STURTEVANT. Yes, sir. Every thing connected with the experiment was done on a parallel line. I don't think you can get any thing more out of that than failure. That is all I can make out of it, except as illustrating the caution required in experimenting, and the difficulty of it. That is all I gave it for, and that is all I care to see in it.

Adjourned to evening.

## EVENING SESSION.

The Convention was called to order at seven o'clock, and the chairman introduced Prof. W. A. Stearns, who read a lecture on

## THE UTILITY OF BIRDS IN AGRICULTURE AND IN MIGRATION.

PROF. W. A. STEARNS, AMHERST, MASS.

*Mr. President: Ladies and Gentlemen:—*

With your kind permission I will proceed to speak upon the subject of to-night's discourse: "The Utility of Birds in Agriculture and in Migration."

I shall not hope to be able to add much really new material to the subject in question, but should I glean from our previous knowledge a few perhaps hitherto neglected facts, and present them in a pleasing manner, and in a new light, my labor will not have been entirely lost.

Though I am sensible that what I shall say could have been contained in a half as many words, better chosen perhaps, you must take the good will for the deed.

### Part I. Classification.

As a preliminary to the main part of my discourse to-night, I hope I may be excused for first presenting a little dry detail, as to the natural characteristics of this class of the animal kingdom, and their arrangement in classification according to the latest and most approved authorities. It is a subject about which but little need be said in such a place as this, chiefly for want of time; but that little seems required, more for the edification of those who as yet are unacquainted with the "*new system*," if there be any such, than because it is required here; while it will form an apology for an introduction to the body matter of the pages that shall follow, and perhaps answer such a purpose equally well.

The classification of birds most familiar to the majority is undoubtedly that of Illigers and Vigors, as modified from and added to that of Linnæus, the father of this as of other scientific classification, and consists of seven orders, as follows:—

Raptores, or Birds of Prey.
Insessores, or Perching Birds.
Scansores, or Climbers.
Rasores, or Scratchers.
Cursores. or Runners.
Grallatores, or Waders, and the
Natatores, or Swimmers.

These seven orders have been in general acceptation for the last fifty years, and it is only until recently that the great advance made in ornithology has reduced the whole sub-kingdom of birds to an almost complete definition. It is needless to mention particularly the names of Baird, Brewer, Ridgeway, Coues, and others, as they are too well known to need it; but a few words will explain the latest additions and revisions of this most important field as recommended chiefly by these gentlemen. As formerly the Raptores or Birds of Prey were placed first, so now perfectness of structure and superiority of intelligence has caused the Carrion Crow and Robber Eagle to "step down and out," so to speak, while the well-known Robin, the head of the Thrush family, assumes the head of the tribe, and is soon followed by the more intelligent of the Insessores. As the group now stands we have the following three classes, and eleven orders:—

CLASS 1ST. (*Aves Aereæ.*)—Birds spending most of their time above the earth, among the branches of the trees—in the air, so to speak, comprising:—

ORDER 1. Passares, or Perchers.
" 2. Picariæ, or Woodpecker-like Birds.
" 3. Psittaci, or Parrots.
" 4. Raptores, or Birds of Prey.
" 5. Columbæ, or Pigeon-like Birds.

CLASS 2D. (*Aves Terrestres.*)—Birds spending most or all of their time on the earth, seldom lighting or remaining on trees:—

ORDER 6. Gallinæ, or Runners, Scratchers, and the like.
" 7. Grallatores, or Waders.

CLASS 3D. (*Aves Aquaticæ.*)—Birds that swim in the water:—

ORDER 8. Lamellirostres, Ducks, etc.
" 9. Steganopodes, Pelicans, etc.
" 10. Longipennes, Gulls, etc.
" 11. Pygopodes, Diving Birds.

We cannot stop now to define all these orders, but will simply say that the system of which these eleven orders form the basis, especially of North American birds, though there are very few changes to be made to have the system answer for birds everywhere throughout the world, proves one of the most simple and most expressive of the real position held by this family in nature of any yet devised. It is only those extreme ornithologists, who strive to render difficult that which they should render easy, whose innovations we have to dread. The greatest change, you will perceive, has been made in the second order, which the new system has called the Picariæ or Picarine or woodpecker-like birds, but which the old system has named respectively *Strisores*, or those birds whose third toe is capable of being retracted, so that the bird can stand with two toes in front and two behind, or three toes in front and one behind, at pleasure; also *Scansores* or climbers; also *Zygodactyli*, or birds having their claws arranged two in front and two behind, and containing the woodpeckers alone. Now it was found that the woodpeckers differed in themselves in this respect, so that any order which answered for part really answered for all, so that all those birds whose structure is really so near alike, and whose definition really presented formerly so many puzzling features to the ornithologist, are now classed together and put in their true place, *after* the Perching birds, and *before* the Parrots, which connect them with the Raptores; thus the succession of orders is complete and perfectly natural. Another seemingly great but in reality simple change is the making of four out of one former order; thus the original Natatores becomes Lamellirostres, or Ducks, etc., Steganopodes or Pelicans, etc., Longipennes, or Gulls, etc., and Pygopodes or Diving birds. Each of these appears separate and distinct enough to form an order by itself, and especially when are taken into consideration the birds which are placed in them from their abodes in other countries. But this matter will appear better in print than it does spoken here, so let us proceed at once, with this preliminary view of the subject, to the main body of our discussion.

## PART II.

### THE UTILITY OF BIRDS IN AGRICULTURE.

The utility of birds in agriculture is a subject about which very little has been written, as it is one about which comparatively little

is known. The fact is, that while our standard ornithologists, such as Audubon, Wilson, Nuttall, and others, who had time for such investigations, were unable to incorporate them into their works from the necessity of expense of publication, our later authors have been unable to spare the time for such occupation, though abundantly assured of surety of publication. It is true that a very few authors have mentioned a very few facts connected with the relation between birds and agriculture, but as yet little practical good has resulted to the farmer from them. Although it would be strange if I should be able to add much real new material to the subject as presented to-night, I shall strive to collect, from the various sources, somewhat of the material already before the public, and present it to you in as attractive and practical a light as I may be able.

It is only within recent years that it has been discovered that birds presented a useful and often most valuable part in the economy of nature; what few facts we do know regarding the matter have been obtained more through the direct experience of those who have stumbled on the facts they relate than those who have made any special study of the matter. One great difficulty has been that people looked too far and studied too deeply for facts which were right before them. For instance, people are well acquainted with the fact that hawks, becoming bold, pounce down upon and carry off chickens from the hen-yards and eat them; how many are acquainted with the fact that in hard winters, when pressed for food, crows do this likewise? But what does this signify? Simply that the crow regulates its food from necessity and not from choice. Now carry this fact into operation in the spring into the cornfield. Do you suppose that the crow, being hungry, and dropping into a field of corn, wherein is abundance to satisfy his desires, stops, as many affirm, to pick out only those kernels which are affected with mildew, larva, or weevil? Does he, instinctively, know what corns, when three or four inches beneath the ground, are thus affected or not? Not a bit of it. To him, a strictly grain-feeding and not an insect-eating bird, the *necessity* takes the place of the choice. He is hungry; the means of satisfying his hunger present themselves. He naturally drops down in the first cornfield he sees, calls all his neighbors to the feast, and then roots up and swallows the kernels until he can hold no more. Such, so far as known, are the facts of the case. Do they look

reasonable? Pages and pages of papers and magazines have been used in disputes as to whether or no the crow was beneficial or injurious to agriculture. To me, at least, in view of the above generalized statement, borne out by facts as shown, the answer is plain enough.

Let us take another example: On the other hand, the robin is a bird which, like the crow, has had pages upon pages written upon the question as to whether it was beneficial or injurious to the agriculturist and farmer. It is certainly true that in the summer season the robin raids upon the fruits of the garden, both those which grow upon the vines and small plants bearing them, and also upon the trees, and fills himself with the richest and most luscious that he can find. Not only does he do this, but brings his whole family with him to partake of it also. Now the question has been raised here, too, as I have said, is the robin beneficial or injurious to the farmer? Of course in answering the question we must look fairly at both sides and then find the difference between them, the side upon which this difference stands outweighing the other for good or evil. We will suppose that in the fruit season the robins appear in large numbers and literally besiege the trees and plants containing fruit of some farmer. If, in consequence, the farmer loses everything, then the crop is a failure, as it would be in a drouth or bad year otherwise. Now supposing he loses part, say two-fifths, or even one-half, he yet reaps an average crop—since the insects might have spoiled as much as this—and thus *gives* to the *birds* what he would otherwise *lose* by the *insects* or some other means. Let us see if he gets any return for this expenditure. As the crow was eminently a grain-loving and grain-feeding bird, so the robin is an insect-eating and insect-feeding bird; being such, it prefers insects in their larval, pupal, and adult stage to any other food. This statement has been proven time and again. Experiments have been made and observations recorded that prove the truth of the following deduction,—from the pen of a well-known ornithological writer. He says: "The prejudice which some persons entertain against the robin is unreasonable. Few persons have any idea of the enormous—the literally incalculable—number of insects that robins eat every year. It has been found, by careful and accurate observations, that a young robin in the nest requires a daily supply of animal food equivalent to considerably more than its own weight! When we remember that

some millions of pairs of robins raise five or six young ones, once, twice, or even three times a year, it will be seen that the resulting destruction of insects is, as I have said, simply incalculable." This same writer adds, furthermore: "I have no doubt that the services of these birds, during the time they are engaged in rearing their young alone. would entitle them to protection, were the parents themselves to feed exclusively upon garden fruits for the whole period. But at this time the diet of the old birds is very largely of an animal nature; nor is this the only season during which the destruction of insects goes on. Upon the first arrival of the main body of the birds early in the spring, long before any fruits are ripe, they throw themselves into newly-plowed fields, and scatter over meadows, lawns, and parks, in eager search for the *worms* and *grubs* that, later in the season, would prove invincible to the agriculturist, were not their ravages thus stayed in advance by the friendly army of robins."

Now try the experiment yourselves. Watch the development of the young birds, note the kinds of food their mother brings them, and even dissect the stomachs of a few of these young birds and examine carefully with the lens their contents. Facts are not worth presenting separated from their proofs. Try the case yourselves. Be your own judge and jury. Pronounce your own verdict. I will venture to say that in the face of the nature of the bird and its habits, the nature of its required food, and the nature of verified observations made time and again, you cannot come out far from a correct result. It does no harm to put scarecrows and the like in your trees and garden to drive off the birds, but hardly pays to deceive yourselves in that your killing them will be a material benefit. But, take another point of view: the robin is eminently a *game* bird, and makes the most delicate and delicious eating known, almost; if, therefore, you beg the question, kill a mess for a savory pot-pie, at such a time as when they are in the height of their plunder; you accomplish your purpose, and can say, conscientiously, that you have not violated any law for the good of the community. We have taken two birds, then, the crow and the robin, and settled by appealing to "the nature of the case" pretty definitely the position of each in the economy of nature as well as in their utility in agriculture; taking each from the same standpoint, that we might show how an examination of this kind is to be made.

It may be stated as a pretty correct rule, that wherever the large grain fields of our countries are found growing there the swallows are abundant. This, though true as a whole, is especially true of the republican, commonly called the cliff or eave swallow, and of the barn swallow. The bank swallow comes in for a share of this also. It is well known that the summer range of these birds includes nearly all the central portion and the great grain-growing regions of the West. They are all more or less migratory, and spend their winters in Florida and the southern portions of the Gulf States. We do not here include the chimney swallow, more correctly known as the chimney swift, since it flies in the upper strata of the air, while the three species above mentioned fly low and near the ground. The question which now arises, especially in our New England States, is, does not the swallow (these species above referred to) do more harm as a pest about the houses and barns where it clusters beneath the eaves, and builds its nest in every possible corner, than it does good as an insect-catcher? In many of our villages, as you well know, the houses and barns of the people are fairly over-run with the eave and barn swallow. Hundreds of nests have been counted in the small area of the eaves of a single barn, with as many more perhaps on the other side, without counting those building inside the building. But, as pestiferous as they are with their chatterings, and the annoyance they give the farmer in various other ways, let us look at the other side. The grain fields, especially of wheat and corn, are attacked in the summer by several species of small insects, like the midges and several similar species, that, in the course of the season, destroy millions of dollars'-worth of grain, while often whole fields are nearly ruined by their ravages; when escaping from the pupa-case these insects fly over the tops of the stalks and from one part of the field to another. This time of the year happens to be about the same as that at which the swallow seeks an extra amount of food for itself and its young. Strange to say the swallow becomes the natural enemy of these insects, and pursues them with unremitting vigilance. Supposing that a single pair of birds have a nestful of five young, a full nest complement, though six are sometimes raised, rarely four or less, suppose that each young bird receives thirty visits an hour, at each of which it receives two or three insects, since the old bird catches several in quick succession and stows them away in the sides and corners of

its mouth. We will also suppose that both birds alternate in their visits, and that this is kept up from sunlight to sunset, or a day of say fifteen hours, for the period of being cared for, or say twenty-one days, usually the time required for a brood to begin to feed themselves, let us look at the result. One single nesting of a single pair of birds will have consumed the enormous amount of nearly 500,000 insects in this short time. As I have often known of several hundred of nests being attached to the buildings of a single farmer, while several farmers often live quite close together, it is safe to say that the *benefit* these birds do is simply incalculable.

Let us look still further: The swallows and the bluebirds fight for the boxes which it used to be a great fashion to put up in various places for their reception. Formerly the swallows retained undisputed possession. Latterly, the insect-enemies to all the fruit and garden trees and plants began to increase; the swallows, never staying near the houses to catch their food, were beaten and driven off to the barns where they belong and from whence they continue their raids upon the grain fields, while their conquerors took possession of the boxes, built, and reared their young, getting tamer and more abundant each year, until now they build anywhere they can find a suitable location, be it in the holes of the corner pieces of the house piazzas themselves even. They at once attack the insects about the lawn, and do for the fruit and shade trees what the swallows do for the field, *but each* in his proper place. Still again: The purple martins, for a time, contended with the bluebirds for the boxes. The martins are an indolent set, and, though insect-eating birds, *fly high* to catch their food. So, as they were unable to take the place of the Bluebirds in Nature's economy, they were whipped and sent off to seek for themselves other regions where they belonged. The result is that in New England to-day the martin is comparatively a rare bird, except in one or two especial localities where they are especially protected by the dwellers there. Do I wrongly place these illustrations as a fair sample of what I mean by the economy of birds in agriculture? But I have only given a most common and general example, and one that will be readily understood, in fact, a most simple one. Let us take another, and one that will combine in a measure the answer to a previous question. Formerly, and even to a great extent latterly, the king-bird or bee martin, as it is better known to farmers keeping these latter insects

for the sake of their honey, was voted a terror to all bee-keepers, and a nuisance to the agriculturist generally. But, strange to say, it was found that the immense numbers of other insects that it destroyed more than counterbalanced the evil it did when attacking the honey-bee; but this is not all. For a long time it was found impossible to prevent the ravages of various species of birds upon fruit and fruit-trees during that portion of the summer when the delicious article most abounded. By a strange coincidence I made a practical test of a most important point on this subject some years ago. It was and is well known that the king-bird, the most fearless fighter of the feathered tribe, attacking with violence crows, hawks, and, in fact, any bird that interferes or intrudes in the domestic arrangements of its helpmate, was particularly active in preservation of self and family during the season of nidification and incubation. Several years ago I found that one of these birds built its nest and raised its family in the corner of an eave-spout at the front end of our house. Not five rods from this place stood a cherry tree, of the variety I believe you call the ox-hearts. Here for years we had struggled to see who would get a mess of this most delicious-tasting fruit. For an equal amount of time it had been "nip and tuck," so to speak, between the birds and ourselves. We had tried red flags in the tree, and the birds minded them not a straw; we had put scare-crows and old hats in among the branches, and the birds lighted upon them and mocked at our efforts; we had tried shooting, and though a few birds were killed ten came to the funeral of each, and many of the fine limbs of the tree were so riddled with shot that they died during the following autumn and spring. What to do we did not know.

In our dilemma we suddenly, one season, found the tree clear of robbers, and in surprise and delighted wonderment we feasted off the delicious fruit for the whole of that season. The next season was the same. No apparent cause could be ascertained for this reign of quiet for a considerable while. It was at last discovered that while our friend the king-bird continued its nest in the eave-spout no other bird was allowed nearer than a radius of some twenty or more rods of the tree. This took in another similar tree upon the opposite side of the walk. Thus had been raised to us a natural protector to our fruit. We cultivated the acquaintance of our favorite, threw cotton and pieces of string

where he would find them, and were delighted to find that he took kindly to our suggestions and appeared to become domesticated. Finally, one year, lately, he disappeared, whether killed or no by some mischievous boy or unscientific sportsman I do not know. To our horror the birds returned and our cherries were eaten up.

Still another example: The orioles, when the peas are ripening, will alight upon the vines, eat the peas by the podfull, and then actually amuse themselves by slitting open the pods and emptying their contents, when they cannot possibly eat them themselves, apparently from mere wantonness. These same king-birds, building in an apple tree near the pea-vines, waged such a war with the orioles, that, for one year, at least, we were not troubled at all with the loss of our peas. Now it has been abundantly proven by others, besides myself, that the king-bird, if suitably baited with scraps of cotton, strings, and other loose material suitable to complete a nest, will soon accustom itself to building in and about the orchards, gardens, and even the houses of our farmers, and thus protect thousands of dollars' worth of vegetables and fruits. It is strictly an insectivorous bird, and will not destroy, on the whole, that which conduces to the interests of the farmer. I will set it down in the following statement, which I am prepared to "*back up*" with abundant proof, and further evidence, that the king-bird is one of the most valuable species of birds to the agriculturist, and if properly encouraged will save for him hundreds if not thousands of dollars' worth of provisions in a season. Legislation in regard to this bird should be of the strictest kind.

Another species, doing an immense amount of good in its own quiet way, is the yellow-billed, as also its ally the black-billed cuckoo. These birds build in apple and fruit trees. They are strictly insect eating, while they make terrible raids upon the caterpillar that infests the trees at this season. They should be encouraged in all possible ways.

### BLUE JAY.

With regard to the jay, authorities differ upon which side to place him; he undoubtedly does much to benefit the farmer indirectly, and even more or less directly, and yet he does so much direct damage, and becomes such a ruthless destroyer at certain times and at certain seasons, that it is almost absurd to class him among the friends of the agriculturist.

The blue jays persecute the hawk with unrelenting fury, whenever they find him in anything approaching to a helpless condition; for this they should receive a mark upon the good side, yet they are just as furious towards the owls, who do little but good in their destruction of the moles and field mice, that often do such immense damage to the ripening crops, that for this they should receive a corresponding demerit. The blue jay, when pressed for food, will seek and devour almost anything that he can get hold of. In this he is followed by his northern friend the Canada jay, who makes himself as familiar in Northern Canada as does our species here. When the fit is upon him he visits the nests of every bird in his vicinity. It is an old trick of his to eat their eggs, and should the nest contain young birds it makes no difference to him. Should this prove insufficient he turns hunter himself, and then eats the entrails, and possibly the bodies also, of those birds whom he has captured. It is safe to say that hundreds of beneficial birds are thus destroyed each year. On the other hand, Wilson mentions the fact that a letter from his friend, Mr. Bartram, contains the following remarkable passage concerning this bird. He says: "Their chief employment during the autumnal season is foraging to supply their winter stores. In performing this necessary duty, they drop abundance of seed in their flight over fields, hedges, and by fences, where they alight to deposit them in post-holes, etc. It is remarkable," he continues to say, "what numbers of young trees rise up in fields and pastures after a wet winter and spring; these birds alone are capable, in a few years' time, to replant all the cleared land."

Undoubtedly this statement is true to a limited degree, and anyone who has watched the movements of this bird at all is well aware of his propensity for dropping acorns and perhaps other nuts from the trees upon which they grow. But a single point further about which I feel quite positive, though yet I may be mistaken, is the fact that so far as my observation goes the blue jay does *not* molest *grain* fields, to any great extent, though this is a matter requiring much further attention and record.

### BALTIMORE ORIOLE.

Were it not that the destructiveness of the Baltimore oriole, among the pea-vines in early summer, were too well known and feared, this bird might be classed as among our most useful

friends and benefactors. He confines himself chiefly, as far as observation proves, to a class of insects hardly reached by any other bird; I refer to the Chrysomelidæ or leaf beetles, and the larvæ of many species of insects, inhabiting the tops of such trees as elm, oak, and apple.

His clear, shrill clarion enlivens the early morning of the mating season, and his beautiful plumage pleases the eye; yet he lights upon the peas at every available opportunity, and rips the pods from top to bottom while he eats the young peas, and soon strips the vines. At the end of the season, however, a balanced account shows the credit to be largely in his favor.

### WHITE AND RED-BELLIED NUTHATCH.

Now let us look at a different species of bird, and note the line in which his utility presents itself; I refer to the white (as also the red)-bellied nuthatch. As to the name nuthatch, which is supposed to have been derived from the habit of the bird of cracking nuts, there seems to be some question amongst authorities. Though the bird certainly stores away immense quantities of tender-shelled nuts, like the chestnut and others, Dr. Brewer showed conclusively that it was for the purpose of extracting the insect larva contained therein rather than to feed upon the meat or kernel of the nut itself. However the case may be, strange as it may appear, the white-bellied nuthatch is probably one of our best friends in the economy of nature in saving from destruction our fine forest trees, especially the oak, chestnut, elm, maple, and other rough-barked trees. It has been suggested that the bird injured the trees by tearing off large quantities of bark, and thus exposing the soft inner bark to the weather and to loss of sap; but not a bit of it. The nuthatch is eminently an insect-eating bird; it lives upon grubs and the larvæ of insects, often eating the insects themselves, as any naturalist who has dissected any number of them will admit. Beneath all these pieces of bark thus apparently ruthlessly torn off, the grub was at work, or the insect in the process of laying its eggs was concealed; the enemy was captured and the tree saved. All day these little fellows travel up and down the trunks and branches of the forest; round and round, again and again visiting the same portions, or flying from tree to tree as the prospect of a good meal presents itself. It rears its young in the woods, and there searches all the more patiently for food for its

brood of from four to six young. Kill off the nuthatches and our forests will suffer correspondingly. In these days, when "forest congresses" are in order, one of their first acts should be to protect the nuthatch.

### BLACK-CAPPED TITMOUSE, OR CHICADEE.

Next to the nuthatch the chicadee, perhaps, claims our attention. This is one of the most active, busy, and cheery little fellows of our woods during the summer or our gardens during the colder parts of the year. They always associate more or less closely with the nuthatches, and, in fact, resemble them greatly in habits, though in spirits they are a miniature blue jay. Of a fine autumn afternoon I have often amused myself by lying down in the woods and noting the curiosity of these little fellows as they cautiously approach and peer at one! Be very careful, and one will finally hop within a few inches of you, and, though watching with the appearance of perfect confidence and familiarity, the least movement of the body will send him off with a shrill dee! dee! dee! into the thicket beyond. Among themselves they fight incessantly, and have been said to kill their weak and sickly birds in the nest. They feed upon almost anything when driven by hunger, yet the direct benefit they do the forests is only estimated by the immense numbers of insect larvæ consumed during the year. Their small bill enters where that of the nuthatch cannot. In summer they feed six to eight starving young ones, while they are constantly at work to benefit rather than injure mankind; therefore protect them by all means.

Although I have thus far purposely refrained from saying anything about the woodpeckers, since the question of their usefulness or uselessness seems to be a point of dispute by many of our authorities, I find that in order to complete my line of utility in this particular direction I must refer to them for a moment only. You are well aware that the smaller species of woodpeckers, frequenting forest and garden trees, often perforate them with a most complete network of holes—whether in search of insects or their larvæ, as is probable, or for the purpose of sucking the sap, as has often been affirmed, we cannot say here; the fact remains the same. We know that they *do* do good in this way, in hunting for insects and their larvæ, which their extremely long, barbed tongue is able to reach and *hook out* from a depth of several inches.

Now while the woodpecker searches for large game, the nuthatches search for a size next smaller, leaving the titmouse or chicadee that smaller yet. But we have not finished our economy, since a small, brown and white, active little fellow, smaller even than the chicadee, with a long, slender, curved bill, steps in and picks up the leavings. So quietly does he work that you would hardly know he was there but for the echoed "faint, trilling sound" with which he beguiles the time, and by a sort of ventriloquism sets you looking for him in every direction but the right one. If all the other species I have mentioned do *good* in the economy of agriculture—taken in its broadest sense, though I think that I have not stepped without the boundary of my subject —this species, the brown creeper, surely deserves a place in our list, and by no means an inferior one.

If I am not tiring you, while these birds are at work upon the trees let us see what is being done about the tree-tops and tender branchlets and leaves. What do we find? We are stationed in a woods of tall oak and pine trees, at our right are tall, thickly-branched and foliaged hemlocks, at our left low pine shrubs. After fifteen minutes of patient waiting, during which time we have seen all the above-named birds at their proper work as before shown, we catch sight of a small, fairy-like, winged creature, that flies from amidst the dark foliage of the hemlocks and darts about the outside branches of the trees named with the agility and adroitness almost of a humming bird; he clears the air of myriads of flies and gall insects—which latter destroy the beauty and symmetry of our trees, as well as ruin greatly their foliage—and even seeks the young grub on the leaves. This kinglet, or regulet, as it is often called, is another of those silent workers who keep down the hosts of destroyers of our forest and likewise useful trees, and without whose labors blight and insect ravages would overtake and finally destroy a large portion of our fine woods. Now note a curious fact: Out of the eighteen birds I have mentioned as particularly beneficial to agriculturists and farmers, and otherwise especially useful in nature's economy, all but five of them are more or less constant residents, wherever they occur, all the year around. The five I have mentioned, with a single exception, make up in their presence what they have lost in their absence, by the diligence of their pursuit of injurious insects, while, during their visits in other climates, they carry on their good work as they do here.

I will pass over quickly the wrens, as strongly beneficial to gardens, and plants about the house, and hedge shrubs, from the numbers of caterpillars they eat; the flycatchers, which are of course beneficial; the cedar-bird, who, between taking the habits of a flycatcher at one time and of a most miserable and despicable wretch of a fruit eater at another, renders difficult the question as to which counterbalances the other in the long run; the Maryland yellow-throat ground warbler, so strict a guardian of the birches and alders of the hedges, who eats caterpillars that affect these shrubs materially; the thrushes; the warblers; and the vireos—all of which are of the greatest benefit to mankind—and pass at once to

## PART III.

### THE UTILITY OF BIRDS IN MIGRATION.

I am now aware that I have come to the most difficult, as it is the most important part of my subject,—the utility of birds in migration. To treat of the utility of birds were a matter of comparative ease, as were it also to speak of them in their migration, but it is the combination,—the *utility* in *migration* that is the main point which I wish to emphasize. In order to do this we must first find out what birds migrate—in any numbers, at least—then: from whence. and to where, do they migrate? In the next place we must find: what species are beneficial and why, and what injurious and why, to the farmer and agriculturist? We therefore omit mention of those species occupying a medium position or whose economy is not yet thoroughly understood. We will omit entirely the raptores or birds of prey, with the majority of all the other orders except the insessores or perching birds proper, and confine ourselves to them alone. Let us proceed then to pick out those species of birds which are beneficial or injurious to the farmer in their migration, and see from whence they come and whither they go, and note their economy.

We find that the great body of birds migrate twice a year,—in the spring, during the months of April and May, generally ending before the end of the latter month; and in the fall during the middle to the last of September, and so on until late into the winter months. Birds migrating in the spring generally eat all they can get hold of to pay for the winter's privations, in case they have not had a full and usual allowance; in fall the birds are weak

and poor from their summer's work of rearing the young. In either case they eat heartily all they can contain. The insectivorous birds find the insects just hatching from their chrysalids in the spring, while in the fall they are in the act of turning; in either case the birds find out these enemies to man, and attack them ravenously. In the fall the seed-eaters act as gleaners, and glean the fields, the trees, and vegetation generally, of the grain which often has fallen from the stalk, having died from the ravages of insects, and often containing, at the time, the egg or pupa of the pest. In the spring the gleaners proceed to finish the work begun in the fall; so that it is safe to say that millions of the injurious pests are gotten rid of in this way. Moreover, the birds, in a sort of way, seem to strive to so regulate their migrations that *the time of the year will be the same with them wherever they are;* that is, starting say from northern Maine, where the majority have passed the summer in rearing their young, they progress westward and southward, as the fierce arctic weather presses them, so that they are continually in the region of late summer or early fall, in Florida, Louisiana, and other of their homes and haunts. In the spring they return in reverse order.

Birds migrate for at least two reasons; the first, though we can hardly call it *automatic*, is yet more or less mechanical, and occasioned more or less directly by the weather; the other, we will briefly state, as impelled by lack of their peculiar and specific diet. I say specific, meaning it in the sense that the migration of different species are at different times, since the food of each species differs more or less in its time of appearance; the fact being proven, with but little doubt, that the time of the appearing of the insect that is the chosen food of any species of bird is the same time at which that bird appears, both in the same locality. If, then, a bird's only occupation was securing enough to eat, the following of that occupation would answer all inquiries as to the causes of its migration, on the ground of variation of season alone. Unfortunately this explains but part of the question. Still, we have not reached our final question, but are rather laying out the ground and sifting the material that we may the better determine our results.

Now it is well known that the robin congregates in large flocks before finally leaving for its southern and southwestern home, yet it confines itself to the woods and fields at such times, where it undoubtedly does immense good in gathering insects and grubs, as

well as diseased grain, and seeds wherein are laid the eggs of pests or wherein are contained the grubs of the same. In the same way all our thrushes, though in much more limited numbers, raid upon the pests of the hedgerow and the woods in which they dwell. In the same way the bluebird congregates in large flocks, before final departure for its southern home; though a few remain with us all winter, and do the same for the fields and outskirts of the wood that the robin does for the shrubbery and interior of the forests. The titmice, though they hardly extensively migrate, cluster, and produce the same good locally, destroying everywhere as they go to and fro. In the fields on the sea-coast, the shore-lark herds, one might almost say; but unfortunately it probably destroys more winter rye in one week than it can pay for all the rest of the year.

The ground warblers seeking the shrubbery, and the tree warblers the treetops, unite in scouring the blossomy foliage, and allowing the plant or tree to bud, blossom, and leaf or fruit, as the case may be, in the spring, while in the fall they eat the eggs and grub that would make sad havoc in the next year's foliage if allowed to remain and mature.

The vireos, ever busy among the foliage of our shade and ornamental trees at home, as also contributing their share in our forests, migrate in spring and fall, while they range from Nova Scotia to Texas, and return as they went. While the flycatchers confine themselves to the guardianship of the outside of the trees, these busy, working vireos, concealed among the foliage, are just as busy as they; the injurious insect and grub falls a prey to both.

Strangely does the golden-winged woodpecker, about the only bird of its kind in its tribe, look out after the limbs and branches of the trees in field, on edge of forest, and even in its interior; or search for insects and larvæ among their propagating ground, the rich moss of the damp, half-submerged meadow adjoining the woods; thus becoming, what many do not suspect, a most useful friend in keeping down the enemy.

Thus the good work goes on. Night-hawks and chimney-swallows cluster in immense flocks, and keep the upper air in constant agitation, as they chase their prey hither and thither. Our delicate little humming-bird, ranging, in its varieties, from the Pacific to the Atlantic, and a single species from Texas to even

the cold climate of Newfoundland, watches with fairy-like, zealous guardianship our flowers and fruit blossoms.

It remains but to speak of the *Fringillidæ* or finches, with their allied family the starlings, which I have retained till last. Of these, I am uncertain as to the utility and practical economy of the pine grosbeak, the purple finch, the crossbills, and the linnets; and will leave these, hoping that some future careful investigator will give us the results of a series of investigations as to the relation existing between these birds and the food they seek and require. All are migratory, and all periodical in their abundance or rarity in any given locality. Future investigation will doubtless enlighten us with regard to the *special* food of many of the birds really useful in agriculture, but whose precise economy is as yet either not known at all, or imperfectly known at best. Of these birds I would call especial attention to the yellowbird, or thistle-bird, as it is often called, as occupying a prominent place. It is eminently a seed-eater, and feeds principally in the fall, when its food is gleanings, and when the gleanings are worm-eaten, worm or larva-inhabiting, and otherwise unfruitful seeds. It is then eminently a gleaner in garden and in field, by roadside and in hedgerows. The yellowbird is found migrating from the Atlantic to the Pacific, and from the fur countries to far "down south."

The snowbird and the tree sparrow follow close. They both come together and go together. Immense flocks fill the deserted grain fields and feed upon the gleanings, picking up occasional beetles and grubs that come in their way; both are found from Labrador to the Rocky Mountains; they migrate together and they breed together; they are alike most beneficial in every way to the farmer and agriculturist. The song-sparrow clears the hedges; the swamp-sparrow abounds in swampy thickets; the grass-finch or bay-winged bunting perfectly swarms in fields and along the outskirts of the woods, while the white-throated sparrow is equally abundant in groves and thickets; each migrate in immense flocks; each is found from the Atlantic nearly or quite to the Pacific; each has his place and does not interfere with the other; and each does good in his peculiar and separate line, and, so to speak, aims at remedying a peculiar evil; while each is highly beneficial in every sense of the word. Along the seacoasts the Savannah sparrow fills *its* place. In the woodlands and along mountainous districts, both seashore and interior, the fox-sparrow—the Cana-

dian "*Rusingel*"—that most beautiful songster of the cold regions, migrates in large quantities and helps to retain foliage to our shrubs and trees from the northern Atlantic to the Rocky Mountains, at the very least.

So far one would imagine that the economy and utility of bird-life in nature was all smiles. Lest anyone should be deceived let me say, vow vengeance, deep and continual, on the remaining families of which I speak. Let bobolink and blackbird alike share the odium of utter uselessness. They swarm in tens of thousands; they gormandize; they destroy every seed, grain, or eatable they can come across, and I verily believe are only maddened because they cannot get more. They have no feeling but for their own crops; and when they have eaten to excess amuse themselves by tearing with beak and claws anything of value that they can lay hold of. Thank fortune, they are less abundant now than ten years ago even. Were they wholly exterminated it would be thousands of dollars in the pocket of every farmer in our country.

But I have already overrun my time; I have failed to say one-half the things I had intended to make prominent here, so thanking you all for your kindly attention I will turn my last page.

The CHAIRMAN. Have gentlemen any questions to ask the lecturer?

Mr. WEST. I would like to ask Prof. Stearns one question. He did not make his views quite clear in regard to the crow. There are more doubts in this part of the audience as to whether the lecturer considers the crow a damage to the agriculturist or not.

Prof. STEARNS. I do not think there is any doubt that he is a damage to the agriculturist. He preys upon the cornfield, and eats the corn indiscriminately, whether there are any insects or not. That has been proved by dissection of stomach and crop.

Mr. WEST. Once, I should have agreed with the Professor completely, but I have changed my opinion. Some years ago, I had a field of corn, and I was told that the crows were pulling my corn. On visiting the field I saw that the corn had been badly worm-eaten, but I found only one spear

pulled, and there were fifteen or twenty crows in the field that morning. I had tarred most of my seed, but there was a little strip near the centre of the field, where as my seed run out, and the field was some distance from the house I had planted some corn that I got of a neighbor, without tarring it, and there the crows had done considerable damage.

Prof. STEARNS. I have no doubt that if corn can be protected by tarring, so that the crows will not eat it, they will prove a benefit by leaving the corn and picking up the grubs in the field. But, as a general rule, unless corn is tarred, I think that the crows are tempted to eat it very strongly. I know that has been my experience. Where corn has been tarred, I have never known the crows to touch it.

Mr. SEDGWICK. In regard to the crow as a destructive bird, it seems to me that he is not only destructive of the corn crop, but it is my impression, from the little observation that I have had, that he is very destructive of the eggs of other birds. I remember being much interested a year ago last spring, in watching a pair of crows, flying through an orchard, and in several instances I saw them fly into birds' nests, take out the eggs, and then go on around the field. It seems to me that the remarks of the Professor, with reference to the crow being a destructive bird, are entirely justified.

I would like to ask the Professor, why it is that the barn swallow has disappeared from certain sections of this State. I well remember that when I was a boy, a great multitude of swallows built their nests about the barns on our farms, but for the last five years I have not seen any. I have heard the fact mentioned in regard to other localities.

Another question in this connection: where in the economy of birds does the blackbird come in?

Prof. STEARNS. With regard to the barn swallow, I think what the gentleman says is perfectly true. They are not so abundant now as they were five years ago. But I think that is owing, in great part, to the fact that the nests have been destroyed as fast as they have been built. To be sure swal-

lows are really less abundant, but if you go along the seashore you will find that they are nearly as abundant there as they were say five years ago. I know that is true in a great many cases.

Then in regard to blackbirds. I mentioned the starlings, which are the same as blackbirds. The word is used for both the starling and the blackbird. I don't think there is any doubt about their economy, or, rather, their uselessness. I don't think there is much economy about starlings,—I mean, the red-winged blackbird. The crow-blackbird is very little trouble, and the cow-blackbird is beneficial rather than injurious.

Mr. HUBBARD. May not the scarcity of barn swallows be accounted for by the fact that farmers are building tight barns, that will not admit them? I have two barns; one is built so that birds cannot get into it; the other has knot holes in it; and in the latter, the swallows are as abundant as ever they were as far as I can observe.

Following up the crow question, I want to ask the Professor upon what he bases his remarks that the crow is, in this vicinity, a grain-eating bird? I should not say so from my observation. He eats almost everything. While corn is in the field, he eats it from the cob, but as far as my own imperfect observation enables me to judge, that is about the only time, and the only extent, that he eats corn.

QUESTION. What does he live on all the rest of the year?

Mr. HUBBARD. We know he will take animal food in about any form. In fact it seems as if he lived on almost anything; as if he was as nearly omniverous as anything that grows. I questioned in my own mind whether he was rightly classified.

Prof. STEARNS. The crow is classified as a grain-eating bird, more from the construction of the œsophagus than anything else. I have found that with the finches, the blackbird, and all that class of birds of which the crow is a member, the construction of the œsophagus and the crop is about the same; there is very little difference. In the classi-

fication of Audubon the red-winged blackbird or starling, and the sparrows being seed-eating, the crow, being of the same class, was classified as such. It is true that the crow eats almost anything, at any time, and it is simply placed in that class from the structure of its crop.

Mr. HUBBARD. Rather than through its observed habits?

Prof. STEARNS. Yes sir, rather than through its observed habits; but its habits correspond very closely with those of other birds of the same class.

Then in regard to the swallow: there are two species of swallow, one is the eaves swallow, which builds outside the barn, and does not build inside at all; the other is the barn swallow, which builds inside, and does not build outside at all. They are totally different. The two species, although having their nests inside and outside of the same barn, have no connection with each other at all.

Mr. WETHERELL of Boston. I think Mr. Hubbard has struck upon the true explanation of the fact to which reference has been made, when he says that the swallow is largely shut out of our barns by their construction. I remember that in closing a barn, that I have requested that a swallow-hole should be cut, and the consequence is, that there are a great many swallows in that barn, where formerly there were very few. I think that accounts, in part, for the disappearance of swallows about some of our farm buildings. In regard to the remark made by the Professor, that the barn swallow never builds outside, permit me to say that I have known instances where they built near the corner of the eaves of the barn. I recollect seeing it on my father's barn.

The swallow called the "Republican swallow," I regard as a new comer in New England. It is a western bird, I believe. When I was a boy, I never saw that bird, or heard its note, and the first I saw built their nests somewhat in the method the Professor has described, under the eaves of the barn. I think the swallow is a good bird to have about a barn, as it catches a great many flies that trouble the cows and other animals.

As regards the crow, to which reference has been made, while I agree with the Professor that the crow is a destructive animal, I claim that it is, at the same time, a useful animal. I believe it is a bird that does a great deal of good, as well as some harm. As was remarked by Mr. Hubbard, there are two periods in the year when the crow does some mischief to the corn-field; one is in the spring (and you have been told how you may prevent that); the other is in the fall, when they take a little from the cob in the field, when the corn is ripening. Sometimes they begin a little earlier than that. I think the destruction of the corn can easily be forgiven by the farmer in view of the great utility of the crow as a grub eater. I have always been a friend of the crow for that reason.

One of the speakers has referred to the fact that a field of corn, where the seed was tarred, was not troubled with the cut-worm at all, while the neighboring fields were badly injured by that worm. Crows are also greedy devourers of the white worm, which sometimes destroys acres of grass. I think the crow tends to check the destructive work of that grub, and I think the habits of the crow make it the most perfect scavenger of the bird family. Am I right, Professor?

Prof. STEARNS. I think so.

Mr. WETHERELL. As was said by Mr. Hubbard, it eats anything and everything, whether it is sweet or carrion. It does not make much difference whether it is good, sound yellow corn, or whether it is the decaying remains of a dead cow. The only quarrel I have with the crow is because, as Mr. Sedgwick says, it destroys the eggs and young birds. I cannot defend the crow from that charge, because I think it is rightly and justly made; but there are other birds that do the same thing.

I want to ask the Professor a question in regard to a bird which has appeared here from across the Atlantic, and has become in some localities very abundant. I refer to the English sparrow. There is no question about its being a grain-eating bird. I would like to know what the Professor thinks

about the utility of importing that bird. I will not call it any name, because I do not want to beg the question.

Prof. Stearns. That is rather a hard question to answer. In the first place, a recent document from the public printing office in Washington, of about four hundred pages, discusses this same question, and it has been discussed in other books to nearly the same extent. It is rather a hard question to answer off-hand, and I will not attempt to answer it perfectly; but I think the balance is against the bird. I know that the English sparrow has driven away other birds at times, and I also know that it does a great deal of good. On Boston Common, for instance, since these birds were imported, the elms have continued to grow and thrive, and are the most beautiful trees on the common; there is very little trouble in regard to the worms. But in Australia, they are considered such a nuisance that there is a bounty of twelve cents a head upon them.

Mr. Wetherell. Our friend, I believe, resides in Amherst; I reside in Boston; and I want to say in regard to what he has said about the elms on Boston Common, that if he had been in Boston in August, when those trees were nearly covered with the cocoons of the caterpiller, I think he would have modified his remarks touching that subject.

Prof. Stearns. I stand corrected, sir.

Mr. Wetherell. I want to say, further, that when I went to Boston to reside, in 1856, the common was frequented by many fine species of birds, to which reference has been made so pleasantly by the speaker. Nearly all of those birds that then frequented the common have been driven away. I think the English sparrows are the greatest pests and nuisances that it is possible to conceive. I don't wonder it took a 400 page volume to defend them. Whether it proceeded from the Commissioner of Agriculture at Washington or not, I cannot say, but I should think it would take more than four hundred pages to defend that bird from the shot-gun of every man who loves the useful birds. I think it has driven away the other birds from Boston Common. On the street where I

reside there is a row of linden trees, and this past summer a pair of vireos came along, and no sooner had they perched upon the branches in front of the window where I was sitting than the sparrows went for the vireos, and I saw no more of them, but the sparrows came back chattering the song of victory. These birds are not only pests and nuisances by reason of the fact that they drive away other birds, but because they destroy a great deal themselves. A gentleman recently told me that a piece of rye in Watertown, near Boston, was nearly or quite destroyed by them. I have also seen a statement of a case where a field of barley was nearly destroyed, and the man who suffered the loss had prosecuted, or was about prosecuting, the society with a long name for having introduced that bird into that section. I think he would have a good cause of action against the party. I think it was just about as unwise to bring that pest on to the Boston Common as it was in a former mayor to introduce gray squirrels there, that became such pests that measures had to be taken to remove them. If the English sparrow is protected by the bird law, I hope that that law will be amended, and that every boy who has a shot-gun will be privileged to use it until that pest is driven from the land.

Mr. Lockwood. I would suggest, that instead of sparrows, they introduce crows on Boston Common. One of my neighbors planted his corn, after tarring it, which is said to prevent the ravages of crows. It acted in that way until the second hoeing, when the corn was up some eighteen inches high, and then the crows came in and pulled nearly an acre clean. I leave it to the audience to judge for what reason they pulled it. That gentleman said it was out of "pure cussedness."

Dr. Sturtevant. I want to bear my testimony against the sparrow. I must plead guilty to introducing them into South Framingham. I introduced twenty-five, and let them loose. I have seen enough to make me thoroughly despise them. In the first place, they are so quarrelsome that they disturb one's sleep in the early morning. The second charge is, that they

will come on to the pear trees and pick out the blossom buds in the spring, when they are swelling. I have watched them at a distance of twenty-five feet, using a glass, so that I could see them very distinctly. I know that they destroy great numbers of the blossom buds on the pear trees, and I feel very sure they do the like upon other fruit trees. They also have become so domesticated that they change their habits under different circumstances, to a great extent. They will go into grain fields and pick the grain out of the heads. They seem to become educated to doing that which will do the most damage in every community where they are.

Dr. Riggs. Near my office in Hartford is a tall elm. The sparrows come on to that tree in the winter time in flocks, and denude the branches that have grown the previous season, in the spring, and during the summer. They will take every bud off of those tender shoots that have grown, so that in the spring of the next year, the buds are not there, and of course those shoots do not leaf out, and they have to wait until new buds are formed, about mid-summer, before any leaves appear. In England and Ireland, as I learned a year ago, they hire men and boys to go around their grain fields at certain seasons of the year, and fire muskets or guns to scare them off, or else they would lose their whole crop. They destroy whole crops of barley in those countries. They are very pugnacious birds, and drive away even the blue bird and martin, and nearly every other bird that may come around the premises,—even robins, which are very pugnacious.

There have been very few robins in Hartford this season. The people there feed the sparrows in winter, and while they are feeding spring a net over them, and make a very passable pot-pie of them. That is considered a legitimate business now; no one objects to it.

In regard to crows, they have no crop like a great many carnivorous birds. The passage leading from the mouth goes directly to the gizzard, something like the duck. The duck has no crop, yet the passage leading from the mouth to the gizzard in the duck becomes considerable enlarged; but in

the crow there is no enlargement of this passage, but everything passes directly into the gizzard, and there it is digested.

Now, as to their eating corn. I have raised corn and watched them closely, and been on the field in less than a minute after the crows had left it, and found that they had pulled the corn, hill after hill, marching from one hill to the other; but not until the corn had got softened and had come up would they molest it. Also, in the fall, they will come in droves on to a field of corn, where it is in stacks, and will go on to the stacks in dozens, and there they will pick into the husks and pick out the corn and put it into their gizzards. They are very predaceous too, in regard to young birds. An apple tree near my barn-yard had a nest of young robins. Happening to be at the barn, I heard the old robins making a great ado, and looking at this tree, saw a crow in the branches. Presently another one came, and when the second one came, they raided upon the nest, and each one took a young robin by the neck, and dangled it in the air as they flew. I have also, in my rides along what you call, "the meadows" near the Connecticut river, seen some crows at work in the bank where the bank swallows made their nests, and, stopping my horse, and calling my companion's attention to it, we saw that one of those crows was digging its way into the bank, and absolutely flew away with some of the young birds in its bill. Yet they are great scavengers. In the spring, they get a great many insects and moths from the ground, after the furrow has been turned by the agriculturist, and do a great deal in picking up those large white grubs, with red heads, that do so much destruction in our mowing fields sometimes.

Cut-worms travel in the night, as every tobacco man knows, if he has watched them. They never travel in the day time; but at night, if you will take a lantern and go quietly into your tobacco field, when the tobacco plants have begun to grow, you will find these cut-worms traveling on the surface of the ground. They come out and go at the plant and do their mischief, crawling up an inch or two to get

under the tender leaves. If you go in the morning and dig into the ground at the foot of that plant, you will find him, plump and fat. I could never see where the crows dug for those worms in a corn field. If they would, it would compensate somewhat for the mischief which they do otherwise. I think the account with the crow is about an even thing. I would much prefer to have the crow around than to have the Irish sparrow. It is called the "Irish sparrow" in England, because it is so pugnacious. They say it is rightly named.

The king-bird, also, has no crop; everything passes from the œsophagus right into the gizzard, and there it goes through the mill. Instead of eating the working bee, the one that makes the honey, they take the males called drones. A king-bird will sit on the branch of a tree near a hive, and when a drone flies into the air, the bird knows him in a minute, and will fly up and catch him, and go back to the same limb and sit for another. The only difference in that regard is, that when a queen bee flies, they are apt to take her, and when they do, the apiarist must look for a new queen for his colony.

Mr. Wetherell. I wish to say, in regard to the crow, to which reference has been made, that perhaps the crow, like the robin, may hunt those worms by ear, or instinct, or both. I suppose the doctor has often seen a robin run along upon a grass-plot, especially if it has been recently mown, turn its head one side, and then thrust its beak in and draw out an earth worm. I have seen that a great many times. Some people make the point against the robin, that in destroying the earth worm, he destroys what is more useful to the farmer than the robin itself. One would think it was so, in view of what Darwin has recently published.

The speaker has alluded to boys and unscientific sportsmen destroying certain birds. That calls to mind the fact, that in Massachusetts—I do not know how it is in Connecticut—a license can be obtained of the selectmen of a town authorizing a scientific sportsman to go out and shoot birds for scientific purposes, as claimed, and also to gather the eggs for

scientific purposes, as claimed. You are probably not aware of the large number of *scientific* bird-shooters and egg-hunters that are licensed in Massachusetts; but when you go along the street and see the eggs exposed for sale that have been prepared for decorative purposes, you begin to think that there is considerable business *scientifically* carried on in egg hunting. Therefore I think the legislature of Massachusetts have empowered a body of town officers to undo the work which they very well did with reference to protecting the birds that are useful to agriculturists and to farmers generally. I think that part of the law should be repealed, because it gives a license to a few to shoot birds and rob their nests, as the law in some of our States (I don't know how it is in Connecticut,) licenses a few to sell rum and whisky, while the majority are debarred from doing so. I think that licenses to do a wrong act are hardly tolerable.

I will say, now that I am up, that I have been exceedingly interested in the discussion of this subject that has been presented to us this evening by Prof. Stearns, and I think that he has spoken very temperately with reference to it. I think he could have made his claim for birds a good deal stronger. I believe that the king-bird, to which he has referred, belongs to the fly-catching tribe, does it not?

Prof. Stearns. Yes, sir, it is at the head of fly-catching birds.

Mr. Wetherell. It is a bird that feeds mostly on the wing, like the swallows. Therefore I trust there will be an interest aroused among the farmers of Connecticut, through this paper, to protect the useful birds. It is said that in many localities in Massachusetts,—and I presume the same is true in Connecticut,—that the birds seem to be diminishing. I think that the shooting of birds has had a great deal to do with it, and I wish that this destruction of useful birds might be stayed.

Mr. Augur. I would like to ask Prof. Stearns one question in regard to the robin. We find that the robin is very destructive to fruit, particularly the strawberry and the cher-

ry. An acquaintance of mine who found that his cherries were being taken off very fast by the robins, took his gun one day, and by actual count shot forty robins out of his finest cherry tree. Perhaps we can get along with the robin, if he does enough good to counterbalance the damage he does to our fruit; but my impression has been, that it is the earth worm, mostly, that the robin chooses. However, it has been claimed that the robin destroys a great many curculios. I would like to ask Prof. Stearns whether examinations of the crop of the robin, from time to time, have shown this to be a fact?

Prof. STEARNS. I cannot say as to that. I have never had any experience with any thing of the kind. But I should think it very probable that it could be so, from the nature of the bird.

Dr. BOWEN. I was very glad to have the subject introduced here by Mr. Wetherell of the scientific destruction of birds by unscientific men. In my county, I think the boys destroy more eggs of birds than all the crows in New England put together. We know how manias spread among boys. There was a time when there was a mania for collecting postage stamps, and now a mania for collecting birds' eggs is spreading among them. I have forbidden boys to cross my farm at all, yet I find them there. I have tried to reason with them, and tried in every way to prevent them robbing birds' nests, but I cannot stop it. I think it the duty of a convention like this is to influence the legislature, as far as they can, to protect birds from all sources of annoyance. As one source of annoyance I will mention the sportsmen who cross our fields continually, from one season to another, evidently for the purpose of shooting game birds,—always out of season. They cannot find any game birds, so they fill their bags with any birds they can find. I think it is the duty of this convention to take some action to influence our legislature to pass a law that will prevent this wanton destruction of birds.

Mr. SEDGWICK. Is it a fact that some of our agricultural societies offer premiums for the best collections of birds' eggs?

The CHAIRMAN. I was not aware of it.

Mr. PRATT of Cornwall. I know of one that does. I would like to ask the gentleman who said the crows pulled up his corn when it was eighteen inches high, what kind of tar he used? I have used coal tar for five or six years, and I have never had a spear pulled.

Mr. LOCKWOOD of So. Windham. I can answer the gentleman here who wanted to know how they found where the corn was that was not tarred. They did it by sampling in my field. They went around sampling here and there. I left a little corner planted with corn that was not tarred, because the tarred corn gave out. They destroyed that by wholesale.

Dr. RIGGS. There was some mistake about that. I never knew a crow to touch corn after it got to the second tier of leaves.

Mr. LOCKWOOD. I can bring you testimony enough to prove the fact.

Dr. RIGGS. I would go fifty miles to see that. I don't doubt you have been informed so.

Mr. LOCKWOOD. No, sir; I saw it myself.

Mr. PRATT. Pour boiling water on the corn before you apply the tar. A large table spoonful will color a pail of water.

Dr. RIGGS. You must stir it continually, because if you do not stir it, you will kill the life of the corn, so that it will not come up. I have been caught in that trap. You may pour it on very hot, if you will keep stirring it, and not use too much tar. If the water is hot, it will dissolve the tar, and as you pour it on, it will coat every kernel of corn, and not a crow will touch it. They will even leave the field in some instances. If you let the water stay upon your corn any length of time, it will kill the chit, where the corn first starts, just as certain as you do it. You want to pour it off and cool it almost instantly after you have got it stirred up very well, so as not to have it kill the corn.

Mr. GOLD. I have had corn pulled after the second hoeing, when the scare-crows had been removed from the field, and

the corn had got pretty good size. I wont say it was eighteen inches high, but it was good stout corn. In that case, I believed that they pulled it from sheer malice.

Mr. AYER. I have regarded the crow, for the last five years, as a particular friend of the farmer. I have planted from eight to twelve acres of corn each year, for five years, and I don't think I have lost twenty hills of corn by crows. A tame crow is a very mischievous creature. They seem to know a great deal. I have known them to eat jackknives, spools of thread, and various things of that kind. They did not want for food, but they did it out of pure malice, you might say, or love of mischief. In planting corn I never tar the seed, but I do not allow myself to go out of the field until I have got a string around it on high poles, and a wind mill, with a little rattle-box on it, that makes a noise. That seems to be sufficient to keep off the crows. On one end of a field of tobacco, where they got into the habit of going to pick the worms from an old pile of manure, I found no green worms during the season, while they were very prevalent in other parts of the field where the crows did not go. So I regard them as good friends of the farmer as any kind that the Professor has mentioned this evening.

Mr. GOODWIN. I had supposed that the crow was a scavenger of the forest, and did good service in destroying the worms, grubs, and insects that depredated upon our trees. I would like to call the Professor's attention to that. He has answered that they were not; that they were eminently a grain-eating bird. If that is a fact, it would confirm the gentleman's experience who has just sat down. I have raised some forty crops of corn, and whenever I have thoroughly twined it at the time of planting, I have never known the crows to pull it up. I can confirm Mr. Gold's experience. I have had corn pulled up, after my twine was down, in very damp places, in wet times, after it got up to the height of seven or eight inches. But they did not pull it very extensively. I guess they found the grain was rotted, and they left it on the ground.

Prof. STEARNS. If we had every question settled indisputably, we would not have anything to talk about. But there is one thing that this meeting has brought out, and that is, that if we cannot settle anything positively, we can make some approach to a settlement. I think one of the best things about a meeting of this kind is, that it provokes controversy, and brings out different opinions from different people. Of course, we cannot say positively in regard to a good many of these questions, "Yes," or "No;" we have got to have a variety of opinions about them. What we want to do, is to find out facts. I do not pretend to say that all of the things I have mentioned are indisputable, because I would be wrong in saying so.

With regard to what the gentleman says respecting crows eating insects, it is true that they do. I have seen them eat insects on pear trees. I have had tame crows at home, and I have seen them eat insects; but, as far as my observation goes, a crow will eat corn a great deal quicker than he will eat insects. I do not doubt that there are persons who have seen him eat insects rather than corn.

I want to set myself right in regard to what I said about the English sparrow. I feared that the question would come up, and I knew I was not prepared to meet it. I knew well enough that all my knowledge was from hearsay. I have seen letters, and scraps taken from newspapers, which have borne out that statement with regard to the English sparrow and the trees on Boston Common. Now, the gentleman at my right (Mr. Wetherell) says it is not so, and, of course, those statements to which I refer must have been made by persons who were not absolutely sure of what they said. I should have said in the beginning, what I did not say, that that was hearsay. I should not have put it as my own statement.

Mr. WETHERELL. I did not intend to contradict what the gentleman said, but in crossing the Common continually, that was the observation that I made: that the trees were whitened by the cocoons of the caterpillars, that had eaten off the leaves of the trees, in spite of the sparrows, and in spite of the pro-

tectors that had been put about the trees to prevent the ravages of insects. These caterpillars are like the canker-worm. The female has no wings, but climbs up the tree, and these protectors are put around the trees to prevent them from going up. On Somerset street, in Boston, the leaves of the horse-chestnut trees, for two or three seasons, have been entirely eaten off by caterpillars. The result has been, that several of those trees, which formerly bloomed in the spring, now bloom in the autumn. I have noticed that for several summers. In this regard, it has the same effect that the canker-worm has had upon the Baldwin apple trees, where the bearing year has been changed from the even to the odd year.

Mr. SEDGWICK. Is it not a fact that our singing birds seek the protection of man, and breed better in the foliage around our houses than they do in the woods? My place is surrounded with shrubbery, and we have a good many song-birds, but I have often noticed, when I go into the woods, that I hear but very few, except the jay. You see no robins in the woods, but around houses you notice them, and you notice other song-birds. I have never seen it stated, but is it not a fact that where the birds are protected around our houses, they increase, instead of in the woods?

Prof. STEARNS. I think that is so. I think that the insect-eating birds, as a rule, are protected. I think that they do seek man's protection. There are two classes of insect-eating birds, one of which seeks man's protection, and the other is found in the forest, and does not seek man's protection. One of the most exquisite songsters that we have is the solitary vireo, and that bird is found only in the very depths of the wood. But it is not the rule that the singing birds are found in the woods.

Mr. ———. One gentleman (Mr. Wetherell) has suggested that the change of the bearing year, in the case of the Baldwin apple, from the even to the odd year, was caused by the fact that the canker-worms had eaten the leaves from the trees. Is there any reason why the ravages of the canker-

worm should not have had the same effect upon other varieties of apples?

Mr. WETHERELL. I gave the fact, and that fact was given to me by Gov. Boutwell, in the town of Groton, Mass. I have no doubt the statement would be equally applicable to any other variety, as well as to the Baldwin. In another town, a hail-storm destroyed all the apples in a lady's orchard one even year, and the trees have since produced good crops on the odd years. The lady has made a pretty good fortune from the effects of that hail-storm.

Mr. AUGUR. I would like to inquire, in regard to the quail, a bird that we all esteem very highly on account of its beauty, if it is not, to a considerable extent, an insect-eating bird?

Prof. STEARNS. Yes, sir. The quail and the partridge both are insect-eating birds. They are birds that run on the ground, and eat insects. They eat insects more than they eat your grain, or anything of that kind.

Mr. WETHERELL. Do they not also do great damage to fruit trees by nipping off the buds?

Prof. STEARNS. Yes, sir. In early spring the grouse perch on the apple trees, just about dusk, about five or six o'clock, and eat the buds. Whether they do in the morning, or not, I don't know.

Mr. PRATT. Don't you consider the red squirrel an enemy to the farmers? I have noticed that at times there will be great commotion among the robins about the house, and I have found that the red squirrels have been pilfering their eggs.

Prof. STEARNS. Yes, sir. I have no doubt of it, because the red squirrels do eat the bird's eggs.

Mr. DAY. This question seems to have been pretty thoroughly discussed, and I move that we adjourn. Carried.

## SECOND DAY.

The convention met at 9.30 o'clock.

THE SECRETARY. I have the pleasure of introducing to you my neighbor, Mr. Goodwin, a practical, a successful farmer, who, while making his lands yield him their annual tribute is even more solicitous to keep up their capacity for future production, that this sacred soil trust may be transmitted intact to his children in all its original fertility—rather than an exhausted, barren legacy. He will address you on "The relations of Forests to our Climate, and the Evils Resulting from their Waste and Destruction upon Animal and Vegetable Life."

MR. GOODWIN. I feel somewhat embarrassed at this introduction by neighbor Gold, our honored Secretary. I live upon the banks of the Housatonic, and have to contend with those dry, sandy, barren soils once alluded to by Mr. Webster, when some forty years since he appeared before the New York State Agricultural Society at Rochester to deliver their annual address, comparing his own similar acres at Marshfield with the then more virgin soil of Western New York—yet unlike him I have never been able to overcome their infertility, not having had the purse of Boston millionaires to aid me. Now my friend Gold labors under no such disability. He lives east of me, just over the Crown of the Hill, always in sight from my windows. When old Mother Nature, in those primeval, diluvial times was grinding up the rocks for a soil and scattering them hither and thither with her rushing waters, preparing the earth to become the habitation of man, she struck the brow of this hill with her raking, sweeping forces, carrying their creamy deposits over into the valley below, and dumped them just where this man and his ancestors before him had found their domicil—and it has ever since been called the "Cream of the Hills," while we back of and behind him have had to eke out our livelihood upon the rocks and from the soils thus sacreligously

denuded of their virtues. Is it to be wondered at then that they are well-to-do people, surpassing all their neighbors in their calling, and that their name and their fame alike smack of the Gold-en, shining metal?

But this is foreign to the purpose of our gathering, and I must come to the matter more appropriately before us.

## OUR STORM SYSTEMS AND CLIMATIC CONDITIONS. MODIFYING EFFECTS OF FORESTS.

## RESULTS OF THEIR DESTRUCTION UPON ANIMAL AND VEGETABLE LIFE.

BY E. D. GOODWIN, FALLS VILLAGE, CONN.

Mr. Chairman—I suspect we are not here as mere novices. to learn the first, the fundamental principles of Agriculture; we have long since mastered its primary facts, and it is from our practical experience in applying its principles to our calling, that we are here to take counsel together—and learn the better ways of others.

You cannot expect to bring vegetable life up to its full capacity of fruition without ample stores of appropriate food in your soil to feed from, no more than the animal organism can realize its full development without its full, liberal, appropriate diet. I suspect the law of inheritance, of production, whether it be toward an improvement or otherwise, is as applicable to the vegetable as the animal creation, although in the latter it is more marked and well defined, perhaps. We all prefer to draw our seed or our stock for propagation from a succession of ancestors judiciously selected and well fed.

Now having your soil well stocked with all the essential elements to its fertility, either from its natural, innate virtues, or from these and others added to it by the art of man, and its surface well covered with our selected superior vegetable and animal organisms—what avails all this without the early and latter rains to bless the plant and reward our culture?

As a farmer I have passed through fifty consecutive seasons of varied experience as to sunshine and shower—of heat we are rarely apprehensive of not having, sooner or later in our climate, an ample supply, but with an occasional exception of seasons when

an excess of moisture prevails—my great apprehension has been from a want of moisture sufficient and timely to second all my other efforts and crown them with success. Not only this, but it is my experience that the tendency to extreme dryness is on the increase—and when our own State suffers, especially the more easterly part thereof, as it has for the last season, it seems to me it is a fit matter to attract the attention of this intelligent, this honorable body of Connecticut farmers.

We cannot irrigate to any considerable extent—the watering pot is scarcely adequate to sustain the flowers and shrubs around our homes through the long, trying, dreary periods of our brassy drouths—and we must look to the clouds for succor almost wholly. Now, when you most need their refreshing beneficence, they are the most hesitating and delusive, and the question is, can the hand of man do aught to modify this tendency in our foggy, hazy, half-precipitating clouds, and cause them to give down upon us oftener and more liberally their redeeming showers? This is the question and here is the point of the whole matter. These local, limited showers, here and there, now and then, coming up and moving over comparatively small areas—scuds, as it were, or small storms in miniature, moving in parallel lines from east to west, one day north of you, next day in the opposite direction, and finally giving you your turn of their bounty, are the features of our climatic conditions of the utmost importance—our main salvation and redemption during the prevalence of these areas or zones of atmosphere, incident to our climate when vegetation most needs the refreshing waters to save it from the burning, scalding sun, and perfect its growth and its maturity.

Let us first call attention to our character and conditions as to heat and moisture, by contrasting it to that of England with its limited territory all surrounded with water and subject to an overplus of moisture, attended with a want of sunshine and of heat—just the opposite of ours. Her storms as a rule are more frequent than ours and light, unless it be their local thunder showers, while she very rarely suffers from a prolonged drouth as we do, and then it comes rather as a blessing in disguise. All countries have their peculiar climatic storm conditions and systems, modified by their configuration and location to surrounding waters—and what is there peculiar to us in our system of storms? Our continental slope here in the states is drained by rivers running into the At-

lantic and Gulf, mainly in a southerly direction, while our atmosphere, in its normal state of fair weather, rotates almost constantly with great regularity eastwardly, carrying its surcharged moisture with it into or over the ocean, and the query is, how does all this moisture again return to cover the continent, restoring this constantly-passing-off volume. Mother Nature is orderly and harmonious in all her ways—she abhors a vacuum and all her tendencies are toward an equilibrium of forces in her surroundings.

Now I am not going to enter upon disputed ground and engage in a controversy with theorizing weather prophets. It is a well-established fact or principle that most of our larger, more continental storms strike upon us from the Gulf—tending as a rule in a northeasterly direction—the centre of their track following up the Mississippi valley, striking the Lakes and tending down the St. Lawrence valley upon the ocean—varying from this course and extending beyond or coming short of it according to the innate force, vitality or the off-shooting, propelling power behind. Accumulative forces must have vent and outlet, and the force of the storm may partake of the character of a hurricane—or be of that milder yet grand and commanding type, spreading itself over half the continent—as life-giving and re-invigorating as it is paternal.

Here, then, we have our waters returned to us in our large, periodical, parent storms; and the question is how to retain them, again to be re-distributed by our local, small storms or showers—as a relief to our parched soils during our hot, decisive summers, in the interval between these recurring larger storms. Unless a large part of your surface is covered with forests, the sweeping winds that usually follow after these storms, and the burning sun, soon exhaust your soils again of this moisture—and that moist surface and cool under stratum of air favorable to our summer showers is wanting, and it is our forest depletion from the Lakes to the Atlantic that tends more and more to extreme dryness. A less frequent class of storms, covering less areas, are those striking in upon our Atlantic slope from a southerly direction rather than in upon our Gulf Basin—more violent from the fact that their feeding, propelling winds are unrestrained as they strike in upon them from their ocean paths—unlike the feeding, propelling winds of our interior storms—moderated as the latter currents are by your interior land formations with their forest covering to retard them. Hence the distinguishing features of the storms are the intensity

and destructiveness of the former, compared with the more mild, paternal character of the latter—a wise Providence being recognized by the preponderance of those of a more mild, paternal type.

I would not be strenuous in insisting that all our large and more continental storms emanate from the great central-built storm regions of the topics; I call this the parent source of the storms, and yet an occasional large storm evidently comes in upon us from a northwesterly or northeasterly Atlantic source, and it is these latter storms that our Meteorological Reports fail to indicate. The point is how to retain these constantly running waters in sufficient quantities to favor more frequent local showers; and here is where the utility of our forests comes in. Your vast deposits of coal indicate that a wise Providence contemplated another mission to them than that of furnishing fuel for man. The influence of forests upon climates is varied, and as efficient in their modifying forces when they cover the valleys and the plains as when upon our more elevated and mountainous areas. They shield the soil alike from the burning sun and your penetrating frosts, enabling it to hold alike in summer and in winter our surplus moisture—not only furnishing thereby constant sources of supply to our springs and rivulets, but moderating the extremes of Summer's heat and Winter's cold, alike favorable to both animal and vegetable life. They not only wrestle with the winds and moderate their wrath, but hold under their protecting embraces a moist, cool substratum of air—while from their leaves a vast volume of moisture is constantly breathed out upon the surrounding atmosphere, favorable to the formation of dew and rain, and especially conducive to more frequent showers in the hot intervals between our large and more continental storms. I have watched often our cloudy, rainless days, giving every promise and appearance of precipitation, yet it did not come upon me, while in the distance, as these same clouds struck the heights of Mt. Washington passing off easterly, they precipitated their moisture on the regions beyond, from a change of electric tension as I suppose, incident to striking their more cool, moist summits. Take the region of country west of Connecticut and Massachusetts and lying between them and the Lakes, and it is but seventy-five years since it was almost one dense, splendid forest region: now, save the more easterly, mountainous parts, it has become almost wholly denuded of

this paternal, shielding covering. The sun penetrates and exhausts its soil of its moisture; the winds whistle along unimpeded; storms are repelled from, rather than attracted to such areas, and when they do drift over them they gather no increased vitality and moisture, ready to precipitate it upon New England when they reach us—and we watch all their delusive promises in vexation and disappointment.

Providence so administers and attempers matters with mercy as to turn man's follies, as his wrath, to her account: our exhaustive system of husbandry has already, here in our older states, long since retired our worn out lands back to a state of nature to again become covered with forests, recompensing man's neglect by again ministering to his necessities—and ultimately regaining her original fertility to again cater to his food wants also. It is not so much the want of forests here in the westerly part of our state and in that of Massachusetts also that I would call your attention to; our mountainous formations in these regions insure to us a comfortable proportion of wooded lands, with their natural adaptation to forestry—always readily sprouting up and growing again when cut off—while in Central and Western New York their timber lands, when once stripped off rarely sprout again from the roots as ours do. It is these remote regions that prepare the clouds as they pass over them to precipitate upon us, and all that storm phenomena of to-day which turns out a mere abortion of cloudy days should precipitate more and more upon us, as of old, before these regions had thus become denuded of their stately forests. I would also call your attention to the difference in their climatic influence between our old original growths of forests, with their tall, majestic, commanding oaks interspersed throughout, to that of the new, more bushy, scrubby growth; the powers and influence of the one when compared with that of the other is like that of our revolutionary races of men, compared with the present generation—and I have often thought that the physical development of man partook of and was in keeping with his forest surroundings. Some ten years since I attended church in Rochester—the church of the Puritans' choice, where you would expect to find men springing from the blood of her first pioneers from New England—and I was astonished at the number of the extremely tall, broad-chested, well developed men, well on to eighty, while none of the young sprouts indicated such promise of vigor and power.

The commanding effects of such stately forests must be especially conducive to a great moderation of our winters. Even conflicting scientists agree as to their ameliorating attractive influences, tending to milder and frequent storms, while certainly they not only hold a large body of warm, moist air in their embraces, with their underlying soils still further saturated with unfrozen waters, but a still more conspicuous feature of their mission is that they prevent that extreme radiation of heat from these very protected bodies of saturated air and earth, while from surfaces stripped of their forest covering—the alarming, excessive opposite extreme of radiation is constantly going on, and if you will only reflect upon the change of temperature from sundown to sunrise in the morning during our clear nights, either in summer or winter, you can appreciate the magnitude of the change thus wrought out in these surface conditions, by the removal of this forest covering from the face of the earth.

I think Jefferson estimated the necessary, essential proportion of forest areas at three-fifths of the whole surface—and a wise statesmanship would encourage the regaining the more healthy proportion of the one to the other.

I know of no better dedication of the tax from whiskey and tobacco by the general government, than to this purpose—and I trust this more voluntary tax of theirs upon consumers of these products, will not be abolished, until the immediate necessities of the future shall become more apparent.

I am not familiar with the more easterly parts of our state—but judge we in the northwest corner, occupying as we do the connecting mountain ridges between the Alleganies and the Green mountains, have better assurances of forest covering than most other parts of these areas—while I am quite sure we suffer less from want of showers than most other regions. I have often noticed that we occupy the dividing line between those storms going north of us and those tending on to the Atlantic below or in a more southerly direction, and I find that our Meteorological Charts give quite an increased rainfall to a belt of country crossing our corner of the State from northeast to southwest. I know it often rains from the Sound just up to us, and not extending far beyond, and so from the opposite side of us. I suppose the storms lap over on to our more mountainous formations from either way, while they do not extend beyond. It has been my practice for

years to watch the extent of most of our storms, and this audience will scarcely believe me when I tell them I have known it to rain almost two hours at a certain point during one of our summer showers, raising a well four feet, when the breadth of that shower in a north and south direction was scarcely three miles, and yet such is the fact.

To beget a storm two or more systems of clouds seem necessary, of different temperatures and of such opposite electric states as to attract each other—and when they thus embrace and commingle with each other the bantling storm itself is born. There seems a vital organizing force to storms, whose mysteries we cannot grasp any more than we can the vital, life-giving energies of the animal and vegetable world. We cannot ascend to the clouds or bring them down upon us to handle and analyze. They are manifestations of that Infinite energy everywhere dominating around us; parts and parcels in the grand panorama of the forces of nature making up the Divine life itself. While we may partake of the blessed fruit of these activities, we must bow in silent, grateful adoration to her dispensing hand without fathoming the mysteries that enshroud her.

I would not be dogmatic or assume the role of school-master to others—I choose to suggest rather than instruct—and yet when a man's life-long experience and observations are confirmed by the teachings of others, he must respect them, though in antagonism with the popular current. The human soul is easily varied by its surroundings, like the magnetic needle—it must be watched and guarded in its processes or it will vary in its reckonings from the ways of truth and justice. Thomas B. Butler was an ardent lover of nature, and if he could not penetrate her mysteries, he loved to watch her ways and point them out to others—and we shall never do justice to his memory until the popular mind more fully grasps the mysteries of the clouds and learns to track the paths of our storms. Had he lived to vindicate his fame, the laurel crown so justly his would not have been worn by other brows, while the apathy of his native state had given way to national recognition. The ardent, genuine lover of truth rarely lives to fulfil his mission—as he nears the goal of his ambition and is about to scale the barrier to the ways of the Almighty, a more sublime mission awaits him above, and he is transferred into the Divine presence itself.

NO FORESTS, NO FRUIT.

I am from the more rural regions of our State, and having been fifty successive seasons in the active, practical business of the farm, I appear before you not to advance any new theory or to overwhelm you with the facts and researches of others, but rather to call your attention to the great climatic changes occurring within the limits of my experience—its alarming, threatening nature, not only to fruit culture, but to the whole vegetable and animal kingdom. Why is it we fail to raise fruit as in our earlier days, even with all our increased attention to it and with all our new and perhaps improved varieties? It is within my recollection that peaches in every neighborhood were as plenty and as little thought of as apples now are, and more uniformly to be relied upon. In 1834 we lost our apple crop by a frost in May—it was a marvel, out of the ordinary course of nature, equally noted by all. Now if a man has a peach orchard and it escapes the frosts of our winters, and, coming to its maturity, bears a crop, he is satisfied as was Moses on Mt. Pisgah, and though, like him, he might not be ready for the last trying ordeal, he would be an enthusiast to expect to see the like again, and might as well apply the axe to the roots. The peach succumbs to our winter climate, of late years, and why is this change? The apple is more hardy and escapes this annual ordeal only to succumb to a more trying one—our hot, dry, withering summers. And why is this also? And then again the enemies to all vegetation, the insect tribes, have become not only formidable in their depredations, but also in their increased species and numbers. What are the conditions so favorable to them of late years in contrast to that prevailing forty years ago? Then we had comparatively few of these pests among us; at that period they were comparatively unknown as far west as Utica, while later still the fairness of the fruit in western New York, in Michigan, and Ohio, has attracted my personal attention—but now they have these pests more among them, though not to the extent of our regions. In my opinion they are not the necessary concomitants of civilization: they rather result in their extreme numbers and species through the climatic changes wrought out from the reckless, the premature, the unhallowed destruction of our primeval forests—and equally so is to be attributed the unfavorable changes in our seasons, the dryness of the atmosphere and its attendant lia-

bility to heat and cold so destructive to the whole vegetable kingdom, eventuating in the deterioration of the animal race also, including man. As a rule your insect tribes that prey upon vegetation are favored by a dry, warm soil, and by dry, hot seasons; a cool, moist atmosphere with frequent rains is prejudicial to them. This is in accordance with my observations through a series of years. Now, in most respects, your fruit and vegetable products demand exactly the opposite conditions—they require a moist atmosphere with its tendencies to moderate temperatures yet adequate warmth, without the extreme, scorching heats peculiar to our climate for the last thirty years. And the wants of the animal organisms, including man, are in harmony with and subject to these same favorable conditions. This audience is too intelligent to suppose for a moment that our inability to raise fruit arises from any want in or deterioration of the soil, consequent upon its age and exhaustion. The general average productive capacity of our soils has undoubtedly depreciated very materially, but our home lots and choice patches allotted to fruit culture have not thus become vitiated. It is your climatic changes that lie at the bottom of all these difficulties, resulting in a radical change of your atmosphere as to its moisture and coldness, and evenness of temperatures, conditions as favorable to the growth of fruit and the whole vegetable kingdom as they are unfavorable to the propagation of insect life, so prejudicial to the cultivation of these choice products.

The earth, by a kind Providence, in its primeval or natural state is clothed with a forest covering whose protecting, ameliorating embraces cover our lower stratum of air, and shield it equally from the scorching rays of the sun and the sweeping, exhausting inroads of currents of dry, cold air. Its influence is paternal, and you can no more set aside its benign, necessary influence with impunity than you can strip your body of its necessary covering and escape its penalty. The destruction of our forests lies at the bottom of all these evils. The dry, sweeping winds from the northwest rush over us unchecked, taking from our soils their moisture, and the lower stratum of air is left dry, uninvigorating and deadened like an oven. Formerly, before our forests had thus become decimated, fruit flourished everywhere; equally in our inland towns—in the warm, sheltered valleys therein—and upon the more exposed hills. Now, according to my observation, your orchards are almost an entire failure in these interior towns,

especially so in our warm, sheltered valleys. Around our lakes and upon our hills they still obtain an occasional crop, these localities escaping the full effects of our hot, dry summers. At tide water, along our rivers and on the borders of our great interior lakes, the ameliorating influence of these bodies of water still preserves the fruit producing capacities of these regions, but even these localities are affected by the general, continental conditions arising from the sweeping destruction of our forests. Were this audience acquainted with the peculiar localities about me I could point you to this locality and that, confirmatory of my position. I reside in a valley running southwest and northeasterly, hemmed in on the northerly side by mountain ridges, making us oven-like in our imbedded position. We find it impossible to raise fruit there to perfection, while on our exposed hills and in regions having a more open and northerly exposure they raise more comfortable crops. The full effects of our change of climate are here to some extent modified and they do not experience its full force. The forests are not only favorable to the formation of rain, but increase its frequency and more even distribution. When a boy I recollect with what delight I watched our April showers—now almost unknown—and the later showers were more frequent—while rainy days, as a relief to the exhausting labors of the farm came much oftener than for the last few years. There may be exceptional seasons to this state of things, but it seems to have been the general rule according to my observation; beyond this the well attested observation and experience in European countries confirms the principle that the destruction of their forests leads to all these disastrous changes.

The late George P. Marsh, formerly Minister to Turkey, issued many years since an elaborate treatise upon this and its collateral subjects confirmatory of these views, while their application to our own country has long attracted my attention; and I doubt not has been the subject-matter of serious reflection to us all. If these principles are correct, here is the primary fundamental condition essential equally to the normal, healthy development of both the animal and vegetable kingdom, not only assailed and measurably undermined by the wasting of our forests, but the opposite extreme of condition results favorably to the propagation of the insect tribes so destructive to vegetable life.

As I have said, the natural mission of these forests is to pre-

serve those conditions in the atmosphere favorable to rains—encouraging their frequency and more equal distribution at all seasons, and especially so are they favorable to our summer thunder showers. Now storms universally result in medium temperature; a season of frequent rains in summer is not an extreme hot period; in winter, with frequent storms the same medium temperature is maintained, your extremes of either heat or cold being co-incident with your fair, stormless periods. The presence of large bodies of water, though frozen, have the same moderating influences—there is a constant moisture in the air, and though it may feel raw and chilly, yet the temperature in such localities rarely sinks so low as to kill peach buds. In Western Wisconsin the air is dry and the thermometer often sinks below zero to thirty, killing all the tender fruits and giving to apple trees a stunted, dwarfy growth, while in similar latitudes in Michigan, surrounded as it is by water, all fruits grow to perfection with little risk or uncertainty. Nature has ordered the forests with capacities to affect similar conditions in inland regions, and unless we take instant measures either as individuals or as States to arrest their destruction and preserve and increase them, we shall more and more approximate to the climate infertility and bareness of desert regions.

Suppose, for an illustration of the principles I have contended for, this hall or room to represent a Territory or State, if you please. In the early period of its settlement a very small space would represent its first surface area cleared of its primeval forest and devoted to culture. The sun having free access to the soil, warms it up and the atmosphere resting on it also—the latter rising as it becomes heated—and the cool, moist air, protected by the surrounding forest, flows in and arrests the extreme heat of our more burning, dry periods. As new centres of settlement spring up over the State you have the same ameliorating conditions to arrest the evil, but as your population increases and finally your forests are more generally decimated, these sources of reserved, moist, electrified air become too at variance with your cultivated areas, and when these annual periods of prolonged drouth and intense heat are in the ascendant we feel the want of their moderating influence and hence the blasting, destructive results. Medium temperatures are equally congenial to animal and vegetable life—vital vigor suffers from both extremes. A grass and fruit country needs more especially the conditions here

indicated. We have an occasional season when these extremes are not so apparent, marked usually by frequent storms and absence of our cold northwest winds, and in their stead more mild and southerly breezes—loaded as they are with ocean moisture. At such times vegetation renews its vigor, all nature smiles and we with it. But this is an exceptional season, the general conditions of the last twenty-five years are very much as I have indicated, and we must not expect to fare much better in the future.

The earth is a unit, one grand whole or system of organization complete in all its parts. The ocean and the inland seas; the continent, with its rivers, its mountains, its plains and valleys; the animal and vegetable creations therein, with their mutual requirement of organic and inorganic constituents for their sustenance and development, are all intimately blended and mutually dependent on each other. Man stands at the head, the crowning, the objective work or fruition of the whole system. The order, the harmony, the beneficent wisdom of the great Organizer himself is everywhere conspicuous. If we live in harmony with this system, and not at variance with the all-pervading intent, we shall realize our true mission and become wise, useful, and happy. Living in antagonism with these fundamental conditions, or at variance with any part of them, is sure to result adversely, and just to the extent of our departure therefrom. Causes must have their effects—the Eternal Will is omnipotent and is indicated all around us in characters unmistakable. The bounties of Providence are scattered all about us with a prodigal hand, but they do not come to us spontaneously; we must reach out and grasp them with a wise, a firm and energetic will, ere they become ours in fact. Heaven helps those who help themselves, and he who labors prays.

These forest gifts have their mission beyond that of furnishing timber and fuel for the use of man, a mission not confined to one or a few generations, but co-existent with the races of animal and vegetable life. I content myself with calling your attention to this matter not only as individuals, but as legislators, on whose shoulders rests this responsibility, so intimately connected and interwoven with our prosperity as a race and a nation. European governments have long since moved, not only to protect existing forests but to encourage the planting of new, with the most favor-

able results. Sir, the time was when the moral and physical welfare—the rights and the liberties of the people—commanded the care and attention of our legislatures; we have departed from the ways of the fathers; the legitimate consideration of those high, those holy interests must give way to the grabbing, selfish schemes of the day, even though it be at the expense of mortgaging in untold bonds the blood and sweat and treasures of those who are to succeed us. The spirit of the fathers is hushed—their institutions undermined—and last, though not least of all, these forest treasures so essential to the use of man—to the moral, physical, and material welfare of our race—become ruined and squandered in the general scramble, by this fast, this reckless, this prodigal generation, and we and our children, and their successors, are left to inherit the barrenness, the desolation fixed upon us.

Mr. Augur. There is one point in connection with this subject, which has been presented to us so plainly, of such very great importance that I would like to touch upon it. As Boss Tweed said, "what are you going to do about it?" Perhaps many of you will recollect that our Legislature, not long ago, enacted a law for the encouragement of forest-planting. I will not refer to it at any length, for you can all learn what it is, if you do not already know; but it exempts land which is worth less than fifteen dollars an acre from taxation for a period of ten years, provided it be planted with certain varieties of forest trees. Now, I would like to make just one point here, and only one. Nature is often her own restorer, and if you will look at our census abstracts, you will find that the amount of forest-land in Connecticut is increasing. But the question is, what is it? I am sorry to say, that it is made up largely of land which is reverting back to forests of such material as red cedar, white birch, some alder, and perhaps poplar, and other kinds of inferior wood.

Now, gentlemen, here is the point. Look at the encouragement which our Legislature has offered. If we can take that land which is likely to revert back to forest, and, instead of letting it grow up to a cheap, trashy kind of wood, which is not of much value, plant better kinds of timber, like white oak, hickory, ash, and black walnut, where the land is suit-

able; these varieties of valuable timber will grow, and in a few years we shall see the forests of our State very greatly improved, and not only will land which is now comparatively worthless, instead of remaining so, eventually become very valuable forest, and, as I fully believe, the climatic condition of our State will be improved by the development of our forests.

The President. The hour has arrived for the regular exercises of the morning, and I introduce to you Mr. Hodges, who will speak on the subject of trout-breeding, a subject with which he is practically familiar.

## TROUT BREEDING.

BY LEVI HODGES, TORRINGTON.

Only one word is necessary in order to thoroughly stir up a certain kind of dog—that word is *rats*. It is not necessary to explain to this wide-awake sportsman, the rat-terrier, just where the rats are, where they came from, or how many there are of them—by the simple word "rats" you have his undivided attention.

Gentlemen, in regard to that magnificent fish, the trout, it is equally unnecessary for me to make any explanation as to how long he has been known, where his grandfather came from, whether or not Adam and Eve angled for him in Eden's fair garden. I simply say *trout*, and I know I shall secure your attention during the reading of these pages. It was Patrick Henry who said "Gentlemen may cry peace, peace, but there is no peace," but I assure you I do not cry "trout" without knowing whereof I speak. Since the year of our Lord, 1871, I have given much of my attention to the breeding of trout. In heat and cold, in daylight and in darkness, when the thermometer was below zero and when it was above 100° in the shade, at all times, in all places, I have spent these eleven years striving to learn how to save what trout I was fortunate enough to possess, and if possible make them increase to a few more. Losses, disasters, ridicule, and discouragements, have all had their day with me in this matter. Like the man who in the middle of a ten acre lot hung to the mad bull's tail because it was "dangerous to let go," so have I spent my time and energies during these years.

The first thing to decide in the culture of the trout is, are you

in earnest in the matter and can you attend to it yourself? It is useless for any man to begin at all unless he can answer this in the affirmative.

The location should be where there is a never failing stream of water; either brook or spring water will answer, only be sure there is always enough of it. There should be fall enough so that ponds can be built off from the main stream, and high enough to be out of danger in time of freshet. The ponds (for business) are built in this way and the water brought to them by means of a pipe or ditch. Here is the hatching-house, a building say sixteen by forty feet, large enough to accommodate 100,000 eggs, and supply nursery room for 10,000 young trout till they are several months old. Next the ponds for adult fish as near the hatchery as possible. Say two of them; the first for two years old fish, ten by forty, and four feet deep, the second for older fish of twice the capacity of the first. A stream of fresh unused water should run through each. These ponds are small, but for business they are none too small. The fish must be where they can be fed and handled easily. If they are deep enough the trout will continue to grow for several years. The ponds for the young fish, till they are a year old, can be made in the hatching-house. There should be two of them made of pine plank, matched and made perfectly tight. Millions of young trout are lost, and the owners may never know how, by using faulty ponds for the fry. The outlet screens must be very fine, eighteen or twenty threads to the inch, and perfectly fitted. The material for the larger ponds does not matter so that they are made tight and below the surface of the ground. The screens can be made of wood slats or of coarse wire cloth.

When the trout go into the nursery ponds they are about an inch long. At the end of the first year, when they are let into the second pond they are about five inches long on an average, though there will be great difference in their size. I know of no way of making them grow alike. At the end of the second year they probably weigh from one-quarter to one-half pound each. They are then let into the last pond.

### TAKING OF THE SPAWN.

The eggs of the trout are about one-sixth of an inch in diameter, the eggs of the three and four years-old fish being usually considerably larger than those of the younger. I have known of

none to spawn the first year, but nearly all spawn the second. The eggs are nearly colorless when separate, but if massed together are of a beautiful straw color, sometimes of a golden hue.

The spawning season begins in New England from the 13th to 15th of October. The temperature and state of the water has much to do with the ripening of the fish. A warm rain on October 14th will be sure to ripen some fish. If the fish are in pure spring water they will spawn much later than the date given.

Raceways are usually made at the upper end of the pond, about three feet wide and six inches deep, with some gravel on the bottom. As the spawning season approaches the races are covered by loose boards, and the trout work up the stream. In their native brooks the trout, after choosing each a partner, work their way into either spring or shallow water, perfectly absorbed in each other's company. A crowd of other fish follow, the same as the Mrs. Grundys of humanity watch the real and prospective; actuated no doubt by the same motives, curiosity and a hope that something will turn up in their favor. The spawning ground decided upon, the male trout keeps the gossips and fortune seekers at a distance, while the female scoops out a little nest in the gravel. On this nest she emits her eggs, the male lying by her side and impregnating them with his milt. No male trout, however large, will undertake to drive him from her. After the eggs are laid the pair cover them with the gravel, eat up a few, linger around the nest a few days, and then break up housekeeping for the season. Their friends then dig up and eat all they can find of the eggs, staying in the locality as long as an egg can be found. After freshets and frosts, if any are left they may hatch out and wriggle out of their winter home and take their chances in this busy world. All this is the *natural* way of spawning.

The trout-breeder breaks up the meeting in his races by drawing a net up through, and spawners, and gossips, and fortune seekers, are all dumped into a pail or tub together. The ripe females are separated from the rest, also two or three males. He then takes in his hands a ripe female fish, flirts the water from her; bending her body a little backward he presses his finger along the abdomen of the fish, using very little force, and the eggs flow into an empty pan or basin placed to receive them. The fish is dropped into another pail. A male is treated in like manner. The milt and eggs are gently tilted or shaken together in the pan; one or two

more females are stripped into the same pan, and perhaps another male; a little water is added, and the eggs begin to adhere to the bottom of the pan. If the eggs are washed off and placed in the boxes before this process of clinging begins, and, at the same time, give them time to receive the milt, a good impregnation can be secured. But after the process begins they should be undisturbed till they are loose again, which will be from ten to forty minutes, according to temperature of the water, high temperature hastening the process. This work is continued from day to day, sometimes taking the fish from the race and sometimes from the pond. Although this is not a very natural process, still it is very effectual, and, so far as I know, has been found to be the most practical.

The eggs can be obtained by different modes if desired. One is as follows: Sink in the race several boxes three inches deep with bottoms of wire-cloth three or four threads to the inch, with an inch frame and fine screen underneath each. Put an inch of gravel in the upper boxes. In flirting away the female uncovers the upper screen. The eggs are laid and fall through out of reach of the fish and can be gathered whenever wanted. The labor is greater and the impregnation, I think, not as good by this mode as the former. After washing the eggs, which is done by dipping the pan into clear water and gently pouring it off, repeating the process till all particles of dirt and all the milt are poured away, the eggs are ready for the hatching-trough.

### HATCHING THE EGGS.

The hatching of the eggs, although requiring considerable labor and care, is an easy matter. If kept in water where nothing can get them most of them will hatch themselves. But the water must be filtered, fungus guarded against, the dead eggs removed, and for two or three months the water must not fail. Even these items are sometimes difficult to secure for so long a season. All things being equal, I have no doubt that spring water is best for hatching purposes, and in fact for the whole work of trout culture it is preferable. It is drawn into a tank for filtering, and run through flannel screens which are so constructed as to be easily removed and cleaned. It then runs into the hatching-troughs. These troughs are made of pine, usually a foot wide, and six inches deep, and of any required length. It is well understood

that pine wood by soaking in water soon grows a kind of slimy substance called fungus. To the trout-breeder this is a pest very difficult to overcome. It is fatal to both fish and eggs, and so the troughs are charred, or varnished, or coated with tar to close the pores. Still after doing all you will the fungus will grow to some extent for the first season or two that the trough is used. After that it seems to have spent itself and there is less trouble. Each trough is divided into nests of about four feet in length by strips of glass over which the water ripples, all the strips being of the same width and the trough pitch about an inch to fifteen feet. What water will pass a hole one-fourth of an inch in diameter with an inch head will supply two troughs fifteen or twenty feet long, having a fall from the first to the second. On the bottom of the trough is placed fine, clean gravel of even size, and if convenient of a dark color, and about one-half an inch deep. The eggs are placed on the gravel by pouring gently from the pan and distributed evenly over the surface with a feather. From five hundred to five thousand of the eggs can be placed on a square foot of the nest.

The principal enemies of the eggs are fungus, sunlight, rats and mice, and sediment. By keeping out of the trough the light and taking the precautions already named, the fungus can be lessened. By shading the windows and using tight board covers over the troughs the sunlight is guarded against. Rats and mice are very destructive to the eggs and fry, eating thousands of them before the owner can by any chance discover the extent of the mischief. So the eggs must be securely covered, the outlets and inlets all screened, and plenty of poison used. Sediment is the last and least of the enemies named, but it is sometimes a great nuisance, covering the gravel and eggs, leaving the deadly fungus to grow unseen, and in time making the water filthy and weakening the embryo in the egg. All brook-water is full of it, and most spring-water will deposit a half-bushel of it in the course of six months. So the spring is sometimes covered, and the flannel screens thoroughly looked after.

When the eggs are first brought in contact with the milt, if they are ripe, and if the water does not first fill the little cells within the shell of the egg, the growth of the young trout begins. In a few hours a round disk is seen on top of the egg. If the egg is impregnated this soon begins to have a cloudy appearance, then

gives way to a fine white line. This is the spine of the trout, and can be seen if the egg is in spring-water in about two weeks from spawning. The warmer the water the sooner the egg developes. In about three weeks the eye spots, heart, and red blood are visible, and the young fish can be seen to move. The size of the egg remains the same but the young fish is continually growing, and if he is healthy will be of a dark color. After five or six weeks of waiting, with water at 48° or 50°, you may expect to see your first hatched trout. He is usually a very insignificant specimen, and you may look pretty sharp to find him.

### REARING THE YOUNG FRY.

The young fish usually enters this busy world tail first, and spends a few days sometimes trying to butt through the shell of the egg with his head. After a time, he decides to back out, and accordingly does so. He then lies over on his side and wishes he hadn't done so, apparently all used up. He is about half an inch long, and don't look or act as though he ever would be as large as Artemas Ward was among the Mormons, namely, five feet nine inches. As you see by the specimen herewith, he is as heavily loaded as the Republican party. This sac supplies him with food for about the time the egg has been hatching, if the temperature is the same. A few days after hatching, the little fish begin to herd together and spend their time diving into the gravel and corners of the hatching-trough. They do not seem to be inclined to travel any distance, but anxious to get out of sight. As the sac becomes absorbed they become trout in good earnest. I might undertake to tell how small a hole five thousand of these little fellows would get through, but the chances are you would fail to believe me, so we will drop that branch of the industry, only if you see water dropping ever so little through a corner in the hatching-box, it will be well enough to put a little piece of fine wire screen under that place and watch it for a few days. They are not yet strong enough to face a current and so keep away from swift water. They make it their whole aim for the next six months to die if they possibly can. As they become ready to feed they separate and begin to rise from the bottom and begin to forage for food. And now comes the most important work of the whole process. If they can be kept alive for the next three months the battle is half won. The water in the boxes is now raised about four inches, or else the

young fish are placed in the rearing-troughs, which is the better plan. The troughs are eight or ten inches deep, six feet long, and twelve or eighteen inches wide. From five to eight thousand can be kept in each, with a half-inch stream of unused water running in at different places, so as to keep a kind of gentle whirling motion through the box. By this plan the food is kept in motion longer and more readily taken. Screens should be *very* carefully fastened at the outlet. The fry should be fed at least three times a day, or oftener if possible, on scraped liver, sour milk, or any food suitable for them that can be made fine enough, but it must be made very fine or many of the fish will die from starvation. All that lodges on the bottom of the box must be covered every second day with fresh earth. A few weak ones will die anyway. The larger ones should be taken out and put into the fry pond as soon as they are strong enough. They will begin to worry and bite each other very soon, and a weak trout does not dare eat till all the strong ones are satisfied. So he is getting weaker while the stronger ones are getting ready to swallow him, which you may always expect when a trout reaches twice the length of his mates.

Spring now finds the trout-breeder busy feeding, watching, separating, and counting his little fish; getting them into the fry ponds, as soon as they are large enough, where they will grow faster and have greater liberty. As the warm days come on more or less of the young fry begin to show weakness. If a hot, dry time comes in April or May many of the little fellows will refuse to eat, and the water will take them against the screens, where they will die by scores, hundreds, or even thousands. At such a time many a breeder has lost his entire stock of fry within twenty-four hours. A salt bath, or plenty of fresh earth will avoid this great loss, but it must be taken in time, for a sick trout always dies. There are several ways of applying the salt. This is, I think, the best. Take 10,000 fry into a pan of water and stir with a feather a half-pint of fine salt into the water. Keep them in the brine, say, two minutes. They will lie on their backs and appear to be dying. Then pour them back into the box or pond, and in a few minutes they will be all right again. The fungus will peel from their bodies and can be seen on top of the water. I repeat, this will not save the fish that have begun to get against the screens, but will prevent this, if taken in time in many cases. It is a preventive, *not* a cure.

The sales of the young fry usually thin them down, so that by the middle of May or first of June they are no longer crowded in the ponds, and very few seem to be diseased after that time. Care should be taken not to be too anxious to sell all the smaller fry, as they are usually the female fish. Breeders who take the pains to separate their large fry from the small ones, and keep them apart long enough, will discover this to be a fact. It is also the case, as we know, with nearly all other animals, that the young males are on an average the largest.

The late spring and early summer season is a time of comparative rest to the trout-breeder. There is little danger from heat and drought, the care of the winter is past, and he now luxuriously strolls along beside his little ponds of beauties. They know him, and will eat from his hand and amply repay him for his days and nights of anxiety and care.

The growing of the large fish is so simple a process, provided everything is properly constructed, that it is not necessary for us to dwell on the subject. We are only to remember that they will go up and down stream where we have little conception of its being a possibility, and that everybody and everything loves trout and will get them if they can, so we must act accordingly.

## SHIPPING.

The packing of the eggs for shipping and the delivery of fish deserve a word. The eggs are usually shipped as soon as the young fish is plainly discerned. Fine, wet moss is used for packing. The eggs are gathered on a tray by means of a feather, a layer of moss is placed in the box for receiving the eggs, a piece of mosquito netting next over the moss, then a layer of the eggs. more netting, then moss again, and so on till the package is full It is then covered, taken from the water, drained, and packed in sawdust, and can be shipped a thousand miles with little loss, the moss holding water enough to supply the eggs with air. Before feeding the young fry are very easily transported. A thousand can be carried in a gallon of water all day without change. The water is kept cool by using ice freely, and perhaps occasionally aerated by a pump or by pouring. As they increase in size and the weather grows warmer more room is, of course, necessary. Still, there is little danger of loss with proper care.

It hardly pays to undertake to move the adult trout in hot

weather, though it is often successfully done. They should have very little or nothing to eat for a few days before their journey, and receive very careful attention. It is a sad experience to a trout-breeder to see his beauties dying, after he has nursed them from the egg up, but we must most of us have to meet it sometimes. In cool weather there is very little risk. The water is never changed, but kept well aerated and at as low a temperature as possible.

### DOES IT PAY?

In answer to this we can only speak from our own experience. We find that though there is a great amount of care and labor, and sometimes losses, still, as a branch of farming, it does pay. Every farmer can raise what trout he wants himself with little cost. They will not take care of themselves, neither will any other kind of fish, carp not excepted. Breeders who have had long experience in the work can hatch and raise to a year old the young trout, when they can be taken and cared for by any body who will give them any chance at all. We believe also, that as long as there is a market for trout at fifty cents per pound, it will pay to raise them for the table. Not that everybody will make it pay, but *some* will.

The trout is a king among fishes. He never had a peer and I suppose he never will. If it will pay to raise any fish it will pay to raise *trout*.

Mr. Day. I see that the gentleman has a few vials upon the table. If he will explain something in regard to them, I presume it will interest the whole audience.

Mr. Hodges. I will do so as well as I can. The vial in my left hand contains trout eggs. A few of them are about a week old; the rest are from ten to fifteen days old. The eye-spots just begin to show in some of them. They were packed up two days ago; the temperature has been warm, and they have advanced very fast. In the hatching-troughs they would not have been advanced as far as they are here. The larger eggs which you see in this other bottle are about a month old. You can plainly see the form of the little fish. Here are eggs just ready to hatch, and also fish that are just

hatched out. Some of them have been hatched perhaps two weeks, and some of them, I presume, have hatched since I started from home. There is very little difference in the size of them yet, but as the sac becomes absorbed, they will increase quite fast.

Dr. GOODRICH of Vernon. I would like to inquire what effect artificial food has upon the taste of trout, as compared with the trout we catch in our streams?

Mr. HODGES. I think it injures the quality of the fish. I know there are a great many things that enter into that. When I go fishing, and come home hungry as a bear, as every man does, if I have happened to catch any fish, when I have them cooked, they taste mighty good. But if I take them out of my ponds, I do not have to work very hard to do it, and that makes a little difference. I would like to be able to say that my fish taken from the ponds are just as good as those taken from the brooks, but I cannot say it. I think the meat of the brook-trout is of a better texture, is much finer, and there is a gamey taste to it that we cannot get in trout grown in ponds.

Mr. S. KIMBERLEY of Goshen. If you put those fish in a fish-pond when they are two years old, will they taste as good as brook-trout, or will they live with the fish in that pond?

Mr. HODGES. If you should put in a few young fish, you would never find any of them. If you should put in a hundred thousand of them, two years hence you would find a few of them, and they would be nearly as good as brook-trout. Still, it would be a point on which all would not agree. I think the brook-trout would be preferable, then, to the lake-trout.

Mr. ———. I know of a pond where there used to be trout; it is fine spring water; but they have all run out since pickerel and bass were put in the pond.

Mr. HODGES. Most ponds are muddy, and the mud eventually hurts the fish.

Mr. MYRICK. What is the expense of starting in trout-breeding?

Mr. Hodges. That is rather a difficult question to answer. It depends a good deal on the character of your soil. The soil where I built my ponds was rocky, and it cost me five times as much to dig out the rocks and get the ponds ready as I expected it would. If you have good digging, you can fix your hatching-house and the pond in the hatching-house, and two ponds outside, for five hundred dollars, probably, all in nice shape, ready to receive the fish. If you have hard digging, and have to spend two or three months in blasting rocks, it will cost you more. Mr. Kimberley, of Goshen, can tell you about blasting rocks better than I can.

Mr. Sedgwick. It seems to me that this question of trout-breeding is one that ought to interest every farmer who has a trout-brook on his farm. It is a fact that in Litchfield County the trout have decreased. I can remember as a boy going to streams near my place and catching good strings of trout, but now it is almost impossible to get any. In my particular locality, people have taken pains, several times, to get some of the young fry and put them in our streams, but as yet I do not observe that it has had any effect on the increase of the fish, and it has occurred to me that one reason of the lack of fish is our drouths in summer, which tend to increase the temperature of the water, and another reason is, the increase of floods.

In this connection, the fact is of interest to us as farmers, that the fish in our ponds, the little lakes that we have scattered around through the State, have also decreased, partly from the fact that manufacturing industries have been established on the streams which supply these ponds, and empty into them a mass of deleterious matters which are poisonous to the fish, and partly to the fact that the mistaken idea has prevailed that the fish would increase by stocking these ponds with black bass. It seem to me that the stocking of our ponds in Litchfield County with black bass has done more to drive out other fish than anything else that has ever been done. Why, sir, they are the meanest fish to catch that were ever put into a pond, or to eat after you have caught

them. They occupy the position among fishes that the sparrow does among birds. I would like to know from some of these gentlemen who have had experience, if there is any way of eradicating them from our ponds. They are a perfect nuisance. They have driven out the pickerel, they have driven out, or are driving out the perch, and they certainly have driven out the trout.

Now, how are we going to increase our supply of trout in our streams, unless we can overcome some of these difficulties? Here is the important matter in regard to increasing our food supply of fish.

Dr. GOODRICH. In regard to the question, how to get rid of the black bass, I will relate a little experience that I went through at one time. I was over at our reservoir in Bolton, at the fish-way, and I saw thousands of little black bass near the shore. I scooped up several hundred, or perhaps a thousand, put them into a pail, and brought them home, and put them into a pond near my house. Those fish grew nicely until they weighed from half a pound to a pound, when there came the great freshet of 1869, which swept through here and took away our dams, and cleaned out every black bass we had. I have not seen any since. We have got two of our ponds well stocked with perch, and I am well satisfied with the change.

Mr. WETHERELL. I would like to hear from Dr. Sturtevant on the matter of black bass.

Dr. STURTEVANT. This is almost too large a subject to talk of, because one can hardly express himself concisely without creating an erroneous impression. Fishing has been a favorite sport with me. For many years I have been a frequenter of the New York and Maine woods, and not only fishing as a sportsman, but studying the streams and studying the fish. I have also been part and parcel of the enterprise looking to the stocking of some of the ponds in Massachusetts with black bass. I have probably spent days lying prone upon the banks of streams, watching the habits of fish; watching them spawn, and studying them in various ways.

My remarks will apply simply to the lake black bass, and not to those which occupy streams.

You will find, in the first place, that the black bass varies in habit in different ponds. A pond with a rocky bottom will be apt to give you quite large quantities of bass; in a pond with a sandy bottom the bass increase, but they are very difficult fish to catch; and perhaps, as a general rule, they are the most uncertain of fish to catch. I know a lake of ninety acres which is thoroughly stocked with bass, where I can see them in large numbers, where they grow easily and readily to five pounds weight. Myself and my friends will go fishing there for a week at a time, without getting a single bite; and then will come a favorable hour when we can catch them in large numbers, and have excellent sport. They are of little value to the sportsman who goes fishing with the expectation of always catching fish, for he will be often disappointed, even when he knows the fish are there.

But the principal objection to them is, that they kill all the other fish, except the white perch. The black bass and white perch will live together, but all other fish gradually disappear, except the large ones. The pickerel come to the shore early in the spring to spawn; the black bass come later and attack the young fish which are seeking the shore, and in that way kill the pickerel. I know of no one who would recommend the black bass for general use. My own taste does not approve the black bass when cooked.

Now, a few words about trout. I think the fact must be recognized that almost every stream has its own peculiar trout. Often-times they are so marked that you can tell from which of two streams a fish that is shown you comes. They differ not only in the marks, very slightly, but also in the color of their flesh, and in the taste of the flesh. Some streams cannot be fished out. I know of streams where every person in this room might fish an indefinite time during the whole year, and never exhaust the stream. By taking out the large fish, the small fish will increase, being saved from being consumed by the larger ones, so that at the end of the year there

will be more fish in the stream than at the beginning. Such streams are very exceptional. There are other streams where you will find good fishing for two or three days, and take so many out that there will not be enough left to justify going there again, and the fish have a rest, because people cannot catch enough to pay for fishing that stream. If you go and examine those streams, you will find that they rise in different neighborhoods, although very near each other, perhaps, and they run through a different course. A stream that runs through woods, mosses, and forest land (I do not mean simply woods, but where the rocks are covered with moss, and where the underbrush grows near the stream) abounds in small shell-fish, snails, worms, and creeping things of all sorts, which serve as food for the young fish. The great difficulty is to feed the fish when they are very small, before they get large enough to eat large food, and such streams as I describe furnish food to the small fish, and but few of them die. They live and attain their growth, in proportion to the size of the stream. They will increase and grow faster than they can be caught out, because we do not take out the very small fish, but leave them in the stream, for growth and propagation. These streams that are fished out have not these supplies of food; the fish grow larger, and are fewer in number; and when you take them out, there are but few small fish, comparatively, to take their places by growth.

You will also observe that there is another point connected with streams. In a stream which has its head-waters in woods, there are usually found pools, and while, in the hot summer days, the main stream dries up, these pools remain filled, and at certain seasons of the year the trout will travel up to these pools in large numbers; at other seasons of the year they will pass down stream to the larger ponds, where they will spend the larger portion of their time. So you see you have got to have a good many conditions, and it is almost impossible to secure all these conditions. You only find them exceptionally in nature. These are some of the difficulties in

trusting to a natural stream for the propagation of trout; so that, in order to raise trout profitably, we have got to depend upon artificial culture and artificial ponds.

Mr. ANDRUS, of Rockville. What age have trout been known to attain?

Mr. HODGES. I have never known one to be over eight years old. It may be that they live longer. It is very difficult for us to tell, because trout-breeding is yet in its infancy. Seth Green, if here, could tell you much better than I. I suppose that eight or ten years is as old as they usually get to be.

Mr. WETHERELL. How large trout have you known to be caught in a brook?

Mr. HODGES. If I can answer that from hearsay, Livingston Stone states that one was caught in New Hampshire or Maine, in the Rangeley Lakes, and sent to Gen. Grant, which weighed nine pounds and a half, and one which weighed ten pounds—genuine brook trout.

Dr. STURTEVANT. I have seen brook trout that weighed nine pounds and a half myself.

QUESTION. How large fish has Mr. Hodges got in his ponds?

Mr. HODGES. I have none that weigh over three-quarters of a pound. I dispose of them as quick as they weigh one-half or three-quarters of a pound. I have had trout that weighed two or three pounds, but in ponds the size of mine, when they attain the size of half or three-quarters of a pound, they cease to pay. That is, the water is so shallow, and there is so small a body of it, that it is best generally to dispose of them, and fill up with younger fish, rather than to keep them along. If you could turn them into deeper water, they would grow fast and do well; but in small ponds, the better way is to dispose of them, and put in smaller fish.

Mr. KIMBERLY. There is a pond near my house, called Whist Pond, which was stocked with bass in 1869. They put in seventy-five fair-sized bass. Nobody was allowed to fish there for three years. I was very careful myself in

keeping everybody from fishing in that pond. At the end of the three years, the pond was perfectly alive with fish. I don't know that the bass ever bred there. There have been a few good-sized bass caught there; but of pickerel, there have been large quantities caught. The first day after the law was off, there were over five hundred pounds taken out of that pond,—some good-sized ones, that weighed four pounds and a half. Alfred Whiting, of Hartford, caught over twelve pounds. He had only four. John Brooks, of Torrington, caught thirty-five pounds. Malachi Gillett caught thirty-seven pounds—the greatest weight that was brought to my house. That was in one day—the first day after the law was off.

The bass have never injured the pickerel in that pond at all. It is a little pond, covering only thirty-two acres. Two or three men came to my house from a place called Scotland, and stayed three or four days, stopping at my house, and fished through the ice, and carried home a barrel of pickerel.

Mr. Hodges. How many fish were put in there?

Mr. Kimberly. There were seventy five put in. The man who brought them came to my house, and I went with him and helped put them in. I have no evidence that there was ever a small bass in that pond. There have been bass caught there that weighed over four pounds.

Mr. Hodges. That is my idea,—that the seventy-five put in have been caught out.

Mr. Sedgwick. This question is a very important one to us who like fish, and it is important that we protect our ponds in this State from bass being put into them through a mistaken motive. Near where I live, in Cornwall, is a pond a mile and a quarter long, where I could formerly go at any time and get a mess of pickerel and perch. A dozen or fifteen years ago it was stocked with bass, and now it is almost impossible to catch any fish there at all. I have been to that pond fishing, and have seen bass in the water that would weigh from three to four pounds, and I could not get them to do anything but just lie there and look at me.

Now, in Goshen, there is a lake—Tyler Pond—that is famous for its fish. During the past summer, to my knowledge, there has certainly been over a ton of pickerel taken out of that lake. I saw three pickerel, out of a lot of fifteen or eighteen, that were caught in that pond last August, that weighed thirty-seven and a half pounds, after they had been out of the water for some time. That pond has never, to my knowledge, had any bass put into it. That shows what our ponds in their natural condition will do, if they are protected against this worst of all fishes, the black bass. I hope that where we have ponds in this State that are in their natural condition, we, as farmers and citizens, will see that the bass are kept out.

Mr. Kimberly. I would say that in their natural condition the Goshen ponds never had any pickerel. I was told that they were introduced there in 1816. My father was one of the subscribers to have them brought over from New Hartford, or near there, and put into those ponds.

Mr. Yeomans, of Columbia. I think it is hardly worth while to bear down too hard upon the bass. I am not ready to accept all that has been said here. If I have gathered a correct impression (I have not been in all the time), I judge that the remark has been made that the bass do not propagate themselves to any great extent. I have understood from the remarks that there are no small bass, but where they are put into ponds or lakes, those bass grow, and if anybody is successful in catching one, there is one less. If I am wrong in that impression, it is a mistake.

The Chairman. That only applies, I believe, to some particular ponds.

Mr. Yeomans. In regard to bass not being caught, or only occasionally one, I think that is a wrong impression. It is possible that the difficulty may be in the want of skill in the angler. Some ten years ago, there were a few black bass, seven or eight I think, possibly more, taken from Bolton river and placed in Columbia reservoir. Those bass were protected by legal enactment for a certain time, and during

the period of protection there were also placed there some pickerel. When the operation of the law ceased,—it chanced to be on the last day of December of the year,—I will not undertake to tell the year,—from that time onward, for some time, the number of fish taken from the reservoir was remarkable. Then they were largely pickerel, and I presume that I am not over estimating when I say that there were days in which a ton weight of pickerel was taken from that reservoir. More or less pickerel continued to be taken, and some are taken at the present time, but not to such an extent, because the fishing has been continuous.

But now with regard to the bass. Those fish were in the reservoir, but for some reason fishermen were not successful in taking the bass, and there came to be, in that neighborhood, a sort of spite against the bass, because they would not readily come up and take the bait. Well, perhaps they take after the human family. The human family are not always ready to take the bait offered to them. But time passed along, and one day a brother-in-law of mine (you will pardon me for making personal allusions) suggested that we try the bass. It was, I think, along in August. He set a day when he would come over. Previously to that time, I had fished scarcely at all in the reservoir, because I had little confidence in my skill as a fisherman, but when the time came, we went up and selected what we believed to be good ground, and went to fishing. The result of that effort was that we caught some eleven bass, weighing from two to three pounds each. The next day it was impossible for me to go with him, and a little lad of nine or ten years old, who was with us the day before, took my rod and went with him, and the two that day captured thirteen, not spending all day, of the same size. They were very uniform in size. It was thought at that time that the fish caught were simply the bass that were placed in the reservoir, and that in time they might be caught out. But it has not been so. There have been more or less bass caught there ever since. and during the last season there were quite good-sized bass caught. But they are

caught now of all sizes—much more than at first. They vary in size from a quarter of a pound to two or three pounds. The largest that I have ever caught there weighed two ounces less than five pounds.

With regard to the quality of the bass, I am not here to advocate its superiority of quality, by any means; but if those who enjoy fishing can by any process induce the bass to bite the hook, there is certainly a great deal of sport in catching them—much more than in catching the average of fish. And as I have had considerable sport in catching them, I felt as though at least a word should be said in their favor.

Dr. Sturtevant. I would like to correct one misunderstanding. The bass do not appear to attack grown pickerel. The destruction of pickerel comes from the destruction of the young, the small fish of the year's hatching. By reducing these, the pickerel remaining in a pond at first grow larger, and you catch large fish, and think they are really increasing. But as you catch out those large ones, they are not replaced by the young ones, as they would have been if the bass were not in the pond.

Now, in order that you may see what confidence may be placed in my statements, I will give the circumstances in regard to Waushakum Pond. It is leased of the State by an association of fishermen, to which belong many old salmon-fishers and trout-fishermen—men who are familiar with fishing, and who are familiar with fish. This lake of ninety acres has had a man in charge of it for years, who keeps off all trespassers. For years a record has been kept of the fishing on that lake, the number of fish taken, and their weight, so that my information is based upon those figures. This is one of the few cases where you can get accurate statistics in regard to fish. And when I speak of the bass not being a good fish to catch, I mean that they are an uncertain fish. On some days you may have splendid luck, perhaps for two days running, but as a rule you can never depend upon their taking the hook readily, no matter what may be your skill. Now, our statistics show that we have spent several thousand

dollars in putting fish of various kinds into this pond, and in protecting them. Our records show that the pickerel have diminished in the lake, and diminished by the destruction of the young fish by the black bass, which we can observe, and through the catching out of the old fish, not to be replaced by the younger ones. I think, with that exception, the gentleman (Mr. Yeomans) will find that my experience is not contradictory to that which he has stated himself.

Mr. WETHERELL. Do they breed in the pond?

Dr. STURTEVANT. They do breed, and very largely, and when the fish are first hatched out it is quite an interesting operation to watch them. They come upon the surface in a little cloud, and sail near the surface. It is a fiction among writers on fish, that the black bass does not eat its own young. The probability is that the bass do not see the young fish when they are on the surface of the water. They stay in this condition for a few days, and then they gradually separate, and take to the shallow water close to the shore, where the shallowness of the water protects them from the mother fish. I have myself seen instances where the mother fish, which was sailing round and round this black mass of young fish, happened to see them and came up and took large gulps from the mass. My obervation in that respect differs from the experience of others. But they do breed and they breed largely.

Mr. BILL, of Lyme. I was about to come to the rescue, and say a few words in favor of the black bass, but through fear of standing alone, I kept my seat. But since my friend Yeomans has spoken in favor of that fish, I certainly shall do the same, for I have been instrumental, as a member of the Fish Commission, that I have been on for the last thirteen years, in stocking from fifty to seventy-five ponds and lakes in the State of Connecticut. I have never heard a word of objection raised coming from any portion of the State except Litchfield County, where my friend Sedgwick resides. I am confident that they have some other fish besides the genuine black bass. I have seen many times large catches

of black bass from Snipsic Lake, within a short distance from where we now are. I have talked to people in this vicinity in relation to black bass that were taken from Snipsic Lake, and I find that they like to catch them and like to eat them. In New London County we have a number of ponds and lakes stocked with them. I find that pickerel and perch are as numerous in those ponds and lakes as they were before we put the black bass in them. My boys will go to Hog Lake, within one mile of me on one side, or to Rogers' Lake, covering a thousand acres, within a mile and a half on the other side of me, and bring home a fine string of black bass. It has been twelve years since we stocked those ponds there, and I have never heard among the people residing in that vicinity one word of objection ever raised to the black bass. We have since stocked them with land-locked salmon, and within two weeks I have taken one that weighed three pounds and a half. I have seen large strings of pickerel, perch, and other fish taken from those ponds and lakes. I say to you now, and I say it upon my word and honor, I have never heard a word of objection raised by an angler in that part of the State to black bass. I do not believe that the Commission upon which I have been for thirteen years have done a bad job in stocking those lakes. We have been for years past stocking them with other fish, and the black bass do well, the pickerel do well, the perch do well; and the land-locked salmon, and probably carp will do well, give them time.

Now, sir, I only got up to say these few words, instead of cursing that fish, which is considered as good as the land-locked salmon, pickerel, or perch. They protect their young, and in that particular are different from any other fish. You will see the parent fish hovering around them and protecting them. A neighbor of mine caught a black bass in Hog Lake that weighed five pounds and a half. I took him to Hartford and presented him to the Fish Commission. He was viewed from head to tail, from top to bottom, and they decided he was a splendid specimen. I took him and presented him to Governor Hubbard, and the Governor has said to me, over and

over again, that he was the best fish he ever ate. You have his word for it. I mean to stand by the fish that I helped to scatter around the State.

Mr. YEOMANS. Allow me just a word more. I would say, in regard to the statement of my friend Dr. Sturtevant, that I do not undertake to deny that the black bass is a very peculiar fish; but that he will not bite very well, I have not been able to discover yet. As I chance to have a record of a few days' fishing in Columbia reservoir, which I did not know I had at the time I was up before, I will just give that as evidence on the question whether black bass will bite or not. I will say that these were the only days that season that I fished, or attempted to fish, and it was the same season that my brother-in-law was with me. I find, however, by referring to the record, that I made one mistake in speaking of the number of fish caught. I said that we caught eleven the first day. By looking at the figures I see that we caught fourteen, but we lost three by throwing them over the side of the boat, and therefore we saved but eleven.

Now, in regard to this record. August 6, we caught fourteen; August 7, thirteen; August 15, twenty-two; August 26, fifty-one; August 29, the number is not put down, but the weight, fifty pounds; August 30, I caught four myself that weighed seven and three-fourths pounds. There was one other item that should have been put down at the time. I fished with 'Squire Marvin of Hartford, and sent him home with twenty-five pounds of black bass, and I certainly could have no cause to complain that the black bass is not a biting fish.

Mr. AUGUR. I have been very much interested in the gentleman's lecture on trout, but, unfortunately, many of us are in sections of the State where trout-streams do not exist to any great extent; but we have, with the increase of our manufactories, a good many artificial reservoirs, and I rise to ask the lecturer, or Dr. Sturtevant, or any one who may be familiar with the matter, what they would recommend as the best fish to put into those reservoirs which are not stocked with fish. I wanted to ask, also, a question in regard to the

German carp; what ponds are most suitable for them, and whether it is advisable to encourage their introduction.

Dr. STURTEVANT. It is a pretty difficult question to decide what is the best fish, because tastes differ. The land-locked salmon, I think, is the best fish that swims, next to the real salmon. Then come trout; and when you come to the ordinary fish of our ponds and streams, I think for all public purposes, the white perch has qualities which recommend him. He is a fish that will destroy almost everything else. He is like the crow, that we were talking about yesterday: he has a good deal of malice about him. A white perch two inches long in an aquarium, will persecute and finally kill all other fish that we can put in except the black bass. It is a fish that bites readily, and which can be taken with a hook, and is an excellent fish for lakes or for reservoirs.

I do not know any objection to black bass. Lake Cochituate is filled with them, for the purpose of clearing out the small fish which formerly entered the conduit and passed into the pipes leading the water to the city of Boston, collecting in the pipes, and doing a good deal of injury. Many years ago, black bass were introduced for the purpose of destroying the small fish about the mouth of the conduit, and they have been successful. The lake is filled with them. There are very few other fish in the lake. They are in the very best condition for catching. They are very hungry, and they grow to large size. It is only as a public fish that I esteem the black bass. I think that pickerel, for a public fish, in unprotected ponds, is perhaps the best fish we have; but as a fisherman I despise him. I never go pickerel fishing. I do not want him on my hook. And yet, for public purposes, in ponds that are not protected, I know no better fish than the pickerel. I know I am taking the unpopular side among people who have studied fish, but that has been my experience. The pickerel and white perch are the two fish that I would recommend for ponds that are not strictly protected by law or by custodians. I am not at all familiar with the carp. I have never seen one, even.

Rev. Mr. Backus. Before giving a notice, I will repeat a word that I had the honor of saying yesterday morning in regard to the pleasant anticipations our people here have had, in view of the sessions of this body, and I cannot help saying that the papers that have been presented, no less than the discussions that have followed have more than equaled our anticipations. Our anticipations have been more than realized in the fact also that we have been permitted to make new friends and to revive old acquaintanceships.

My notice is this: That in anticipation of this meeting, our mid-week religious service, which is usually held in the First Congregational Church on Thursday evening, at half-past seven, has been changed to one o'clock on Thursday afternoon. Some have felt that, under the circumstances, our welcome was not fully expressed until we gave this notice, and in giving it, we kindly invite all members of this Convention who would like to do so, and can conveniently, to meet with us in our chapel at one o'clock this afternoon. The bell will ring at a quarter before one. I will also say, that if any find it inconvenient to come in until a later hour, I hope they will not stay away for fear of interrupting the meeting.

Mr. Stickney. Gov. Jewell, President of the Southern New England Telephone Co., has sent to you, gentlemen, a special invitation to make free use of the telephone in Rockville to any part of the State of Connecticut. You are very cordially invited to use it at the central office, or at any of the places in town where you may find a telephone.

Adjourned to afternoon.

## AFTERNOON SESSION.

The convention met at two o'clock, Mr. J. J. WEBB, of New Haven, in the chair. The first speaker was Mr. ALONZO BRADLEY, who delivered a lecture on Bees.

### BEE-KEEPING BY AMATEURS AND NON-PROFESSIONALS.

BY ALONZO BRADLEY, LEE, MASS.

In this age of bee literature I do not propose to present new ideas, or any new-fangled theories, neither do I propose to show you any new and easy way of accumulating wealth, but to bring before you the old ideas in a simple form. If I had been invited to talk to old experienced bee-keepers, I should have adopted a very different course from the present.

This enterprise, like all other "*side issues*" connected with farming, must pass under this ordeal: "*will it pay?*" This may be answered briefly, yes. Then again viewed from another standpoint, *no*. I need not present a long array of facts and figures to convince you that it will pay. Success in this, like all other branches of industry, requires enterprise, energy, tact, and love for the calling. Every one is not calculated for a farmer, or for a merchant, or lawyer, or in fact for any one calling, but some for one and some for another department, and some have not energy enough to succeed in any. These may be called *Drones*.

In the State of Connecticut, there are carloads of honey which go to waste every year, for the simple reason that there are no bees to gather it. Mr. M. Quimby (now deceased), who was one of the most noted and successful bee-keepers in America, stated that every acre of land, on an average, produced one pound of honey each year. This is equivalent to twenty-five stocks within a radius of one and one-half miles from any given point. At this very modest estimate the State of Connecticut, containing about three million acres, would produce three million pounds of honey, equal to one hundred and fifty carloads of ten tons each; this at ten cents per pound would amount to the snug little sum of three hundred thousand dollars.

To a person unacquainted with the large honey resources of our farms and waste lands, the figures may seem greatly exaggerated. I am candid when I say I believe they are under estimated. As taken from statistics the annual production of surplus honey in the United States is one hundred million pounds, equal to fifty thousand tons, which at ten cents per pound would be ten million dollars.

Our annual export of honey amounts to one million two hun dred thousand dollars, and is constantly increasing. We have the credit of producing the best in the world. When in Copenhagen I ordered a sample of the best honey in market in order to compare it with ours in America. Imagine my surprise to discover by the label that it was American honey. It is needless to remark that it was of the first quality. The wax product annually amounts to six million dollars. Capt. Hetherington, of Cherry Valley N. Y. in one year sold from his apiary over twenty seven tons. I mention these facts merely to show what undeveloped resources are afforded us in connection with agriculture. There is hardly a field or hill but what contributes abundance of this greatest of luxuries, which, when gathered and properly stored, will always be a cash commodity in the market. You farmers really have only to reach out your hand and take it. I say farmers for the reason that they seem more favorably situated for the occupation, being surrounded by all that is essential to success and supposed to be always at home during the busy season.

To me the surroundings of a farm-house are very incomplete without its stands of bees. These indicate thrift. A person's success in apiculture indicates that he has the qualities to succeed in almost anything. Why is there not more attention given to this branch of industry, when there are so many points in its favor; some of which are:

First. When judiciously managed the profits are great compared with the capital.

Second. It requires no outlay in fields, for pasturage, as no fences or division lines limit the bounds of their forage ground.

Third. They are voluntary in their services, requiring no task-masters. I am sorry to add that their industry costs them their lives.

Fourth. The little care and attention required, usually, can be given, in odd moments and fractions of time. This will be a

relaxation from the continued grind of farm duties. You will find it to be pleasure, industry, and profit combined in a remarkable degree. There are many reasons why this is so neglected, one of which is owing to the number of failures, caused through ignorance of the first principles. Apiculture can be abused and neglected, probably, more than any other branch of husbandry, and yet meet with partial success. Take the dairy, for instance; it must be followed, and pushed with energy in every detail, to make it a success. The same will apply to all the branches of farming, each department requiring our daily and almost constant attention, and doing our best we can hardly show a respectable balance sheet. Now if we give the apiary one tithe the thought and attention given to the dairy, the swine, or the fowls, I would guarantee ten times the per cent. profit.

Another reason may be attributed to the *supposed* difficulty in their management; this is more imaginary than real. With a very limited knowledge of their habits and a little experience in handling, bees can be managed, comparatively, with as little trouble and danger as almost any of the farm stock. If this fact could be impressed, there would be very many more persons keeping bees than there are at the present time. A certain *amount* of knowledge is absolutely necessary to their successful culture, and this can be easily obtained by any one.

The question is often asked, regretfully, "what can be done to keep our boys at home on the farm?" I wish there were more boys here at these meetings. Boys are naturally ambitious, wide-awake, full, running over with animal spirit. This is as the Creator intended. Let us not discourage, but rather control and temper their different traits. Farm life is *made* too humdrum for the average American youth. Give them interests of their own, entirely their own, and independent of any interests in common.

The subject before you this afternoon I should like to have applied for the interest of the boys, not however to the exclusion of the girls. Apiculture when managed scientifically is the most absorbing, fascinating of all occupations, and is *well* adapted to attract and hold a boy's mind, develop his intellect; and the wonders which are constantly discovered in his study, naturally turn his thoughts to a higher and all controlling power.

I would say, boys, read up, inform yourselves, give this subject thought and study, subscribe for some bee journal. After getting

your parents' consent, invest in a good stock of bees, even if it takes your last dollar. Don't borrow the money, but earn it, before making the investment. As a good beginning is absolutely necessary for success, I will make these suggestions.

In selecting a place for an apiary, if there are not too many objections, locate it where the issuing of swarms can be both seen and heard from the house, and where thieves will be shy in approaching. It is important to have it protected from the winds, by a building or tight board fence. If no such place can be obtained, then posts set in the ground, with boards nailed on, will answer the purpose. The stands for the hives should be six inches or more from the ground, and have a short piece of board, making an inclined plane from the alighting board of the hive to the ground; the reason for doing this is, that during the early spring and late fall harvests of honey, the bees coming in heavily loaded on chilly days, and more especially quite late in the afternoon, in some degree relax their efforts as they near their hive. The result is, instead of alighting on the bottom board of their hive, they just fail in this, and but for the board, would pass directly under to the ground, become chilled and unable to take wing again. In this way many of the most active bees are lost. Now, everything being ready, it is desirable to purchase a stock of bees under the most favorable circumstances. I would advise by all means to select in the spring, for then the risks of wintering are passed, the bees have commenced active operations, gathering pollen and bringing in water for their brood, cleaning and preparing the combs for the queen to deposits her eggs, carrying out the filth and dirt that has accumulated during the winter, and performing all the required duties for building themselves up into a strong, healthy colony.

During these operations we are afforded the best opportunity for making our selection. Standing in front of the hives it will be observed that some colonies have at work nearly double the forces of others. It is from these, which are so strong and active, we wish to make our choice. In giving them a more thorough examination, many things are to be considered.

First. At this season of the year, the last of April or fore part of May, the bees should occupy at least five spaces between the combs, but the more spaces filled the better.

Second. The colony should not be over two years old; a second

swarm, if the hive is full of comb is preferable to others, as they build less drone comb, and have a young queen; a stock of bees of any age should be rejected, if over supplied with drone comb.

Third. A vigorous and healthy colony, at this time of the year, should have brood in every comb occupied by the bees, and the brood should extend down nearly to the bottom of the combs.

That we may be enabled to ascertain the exact condition of each stock, blow a little smoke into the entrance of the hive, then carefully tip it back, blow more smoke between every space occupied by bees. This frightens them from their combs and brood, and causes a hasty retreat into the upper part of the hive, thus giving a fine opportunity for inspection. We can easily determine the condition of the combs, the proportion of drone comb, the number of combs occupied with brood, and to what extent; in fact, learn the exact condition and value of the colony, and judge with a degree of accuracy of its probable returns for the coming season. Having finished the examination, place the hive carefully back again on the stand, to allow all returning and absent bees to enter before preparing it for moving, when the bees are to be again smoked the same as before, then carefully set the hive bottom upwards, at once place over the whole bottom a square of cheese capping considerably larger than the square of the hive, place some strips of wood on this cheese capping, tacking it around the edge. Previous to this, however, and even before moving the hive from the stand, with paper stop all holes where the bees are liable to escape. It requires only a few minutes to have all this work well done, and the hive placed bottom upwards in a light spring wagon ready for transporting. In this condition there need be no fear of the combs breaking down during the journey.

Arriving at the place prepared for the colony, put the bottom board on the stand, blow smoke thoroughly all through the cheese capping, then remove it and set the hive on the bottom board, right side up. The next day the bees will assume their accustomed duties as though nothing had happened.

The sting of the bee, doubtless, is the greatest hindrance to the development of apiculture and giving it rank beside that of the dairy and sheep-husbandry.

I have sometimes thought if our cows had stings it would be well, certainly for the cows. It is very rare that a bee uses its sting, except in self defence, or in the defence of its home. At

times I will allow they are more irascible than at others. In the fall of the year, for instance, when the hive is full of their winter stores, the work of the season, they show a good deal of human nature. Then again in stormy, unpleasant weather, early in the morning and late in the day, also during buckwheat honey-harvest.

The handling of bees should be done during the warm part of pleasant days; an *expert* can handle them at any time.

There is nothing necessary to be done with a stock of bees but what can be done by anyone with impunity and perfect safety, by following these few simple directions: In the first place, provide yourself with a bee-veil and a light pair of leather gloves; avoid all quick, sudden motions or jars; in all movements about the hive be very careful and moderate. The breath is objectionable, of course; avoid breathing upon them. A slovenly person is also very offensive. Clothing that has fur or hair about it, woolen gloves, a silk hat, heavy, bushy whiskers, a heavy head of hair—all these excite and irritate. Before commencing operations, invariably use a little smoke. If it is only in tipping up a hive to look under, blow smoke in the entrance, then again after the hive is raised. This frightens the bees, causing them to fill themselves with honey; when in this condition the disposition to sting is removed. Immediately after smoking them, commence operations, accomplish what you intended, then close the hive at once.

When the weather becomes sufficiently warm, or about the last of May, the boxes may be put on for surplus honey. The idea is advanced by some that this prevents swarming; *possibly* it may in some instances.

If the season has been favorable, and your stock strong in numbers, a swarm may be expected to issue the fore part of June. A new hive should be in readiness, measuring inside twelve inches by twelve, and fourteen inches high, with an entrance cut two-thirds the way up from the bottom. First new swarms generally issue between ten o'clock A. M. and one o'clock P. M.

To the owner of his first stock of bees, after anxiously watching and waiting for a whole week or more, what is more interesting and exciting than the shout, "*The Bees are Swarming!*" I well remember the time, when a boy, of hoeing corn during the hot, tedious days of June, when the long hoped-for shout would come, "The Bees are Swarming!" This was the signal for dropping work and hoe and starting on a run to the place of excitement.

The whole scene is intensely interesting, *commencing* with a colony about ready to send out a swarm. The work of the hive has nearly ceased, and the quiet of the bees indicate that a swarm is about to issue; soon a few bees will be seen running in and out of the hive in great excitement, then a few more will join them, flying a short distance, then alighting again and running into the hive; these are joined by still more, the excitement increases until the whole colony has entered into the spirit of migration, and not a bee in the whole hive but what is running here and there as though his life depended upon something. hardly knowing what. By this time the bees are rushing out of the hive with a vengeance, fairly pouring out, tumbling over each other in their haste, all bent on the same purpose.

Sometimes the queen may be seen coming out with the fore part of the swarm, then again not until the swarm has nearly all taken wing. After some minutes' flying, a few bees alight, usually on a limb of some tree; this forms the nucleus for the cluster, and is the signal for the whole swarm, which is very much scattered by this time, to make a rush and center on this cluster; soon all is quiet again—I mean to be understood, as far as the bees are concerned.

To hive this swarm, spread a large-sized cloth on the ground directly under the cluster, placing the bottom board and hive near the center, raise the front of the hive on blocks one-half inch or more; everything being now ready, hold the smoke directly under the cluster until their situation is somewhat uncomfortable; with a dipper take a pint or more of bees and put them in front and under the hive, when they will set up their call and commence running in; put several dippers of bees, at short intervals, down by the hive, when the cluster may be shaken into a large tin pan and turned down by the rest. With a wing brush those down that are on the side of the hive until all enter, when it may be carried and set on the stand prepared for it, and where it is to remain during the season.

If the season continues favorable, nine days from the date of the first a second swarm may be looked for. They are liable to issue any time between the hours of eight o'clock A. M. and six o'clock P. M. Sometimes they will all alight in one place, but quite as often in two separate clusters. At times they are so fickle that it is necessary to shake them into their hive; tie a piece of cheese

capping over, and set them into the cellar until nearly sunset, when it will be safe to bring them out and place on their permanent stand. They will now commence cleaning the hive for comb-building by biting away everything that is rough, making the hive perfectly clean and smooth. At the top of the hive, in the center of the cluster, they fasten and work into the grain of the wood a small piece of wax, no larger than a grain of mustard seed, then adding more to this, the whole is worked over into a rough foundation for comb-building.

In a colony of bees there are pollen and honey-gatherers, which are generally old bees; another class, called wax-producers, cluster in the hive and are fed in abundance with honey, which causes a secretion of oily, waxy substance on the inside of the abdomen, perfectly white, and shaped something like a small fish-scale. This is worked over by the bees and formed into wax for comb-building. Another class are delegated as nurses and housekeepers; this devolves upon the younger portion. A colony of bees is a perfectly organized corps of workers; no idlers are allowed as members.

A great many times, in observing their operations, I have seen the bees dragging out of their hive some *poor* unfortunate, who happened to be born with an imperfect wing, or some other deformity, having no regard to its struggles and pleading tones of distress, which were unmistakably manifested in a very pathetic way.

The queen has the capacity for filling the highest and most important department in the colony, *decidedly* objecting to any copartnership or rivalry, but requiring entire supremacy, occupying the place of honor, having her movements unquestioned. She is entirely unlike any other member of the colony, having no instincts common with them. She has no capacity for labor, no affection for her young, is given to jealousy, vengeance, passion, and fury. Without her the swarm would dwindle away and die. The workers are aware of this, and if from any cause the queen is separated from the cluster the colony is completely demoralized, and in a state of frenzy and delirium; at this time introduce their queen and notice the result: with telegraphic dispatch the whole swarm is communicated with, and the thousands of bees which are scattered over a large territory immediately join the cluster, manifesting every sign of delight. Their demonstrations of anger are deeply impressive, and easily understood. With a very little

observation on the part of the apiarian, their different moods, fear, anger, frenzy, pleasure, contentment, can be ascertained by their actions as readily as in the domestic animals.

All the remarks that have been made refer to the common or old-styled hive, of generations ago. I would not have it understood that I approve of no other, but for a person unaccustomed to the care of bees and negligent in their management, this style of hive is the best adapted for their use, and nearly every departure from this form will be followed by failure; this fact has been demonstrated for one-fourth of a century. To manage bees after the improved method requires a thorough knowledge of the principles of apiculture, with ability to carry them out in a careful and intelligent manner, and patience in observing and supplying *all* their wants at the proper time. If a novice should commence with one-half a dozen stocks or more, in the modern hive, I would predict failure. But to a person who is anticipating bee-keeping as a business, and has a thorough knowledge of its principles, a movable frame hive in some form is indispensable. It gives him the entire control of his bees, and offers the advantage of performing any and all operations with ease and dispatch, and instead of allowing each stock to raise five or six thousand useless drones, we prevent this by removing the drone comb, and substituting worker comb; the advantage of this is, that instead of raising these thousands of drones, which will consume at least fifteen pounds of honey, as many workers are raised, which gather the same amount, making a difference in the product of thirty pounds, which is no small item in the economy of the bee-hive. It is estimated that it takes fifteen pounds of honey to make one of comb. Every pound of comb and foundation used not only saves this amount of honey, but also the time of the bees in its manufacture.

The season for comb building and honey gathering occur at the same time, and it is important that all available forces should be used for gathering and storing the honey. Flowers produce honey only in certain hours of the day, and then in abundance; at any other time there is not a drop secreted. In the full honey harvest, a swarm, having a hive of empty combs, will gather from fifteen to twenty pounds of liquid honey in a day; where they are obliged to manufacture their combs, they will give only one-fourth of that amount. When this honey ripens, by using the extractor,

it can be thrown out and the empty combs returned to be filled again. In this way as many as four hundred pounds have been taken from a single stock during the season. It is such an easy matter to take the honey, there is great danger in robbing the bees, and leaving them short of winter stores.

Another advantage of the frames is, it enables us to multiply stocks at will. The importance of this can hardly be over estimated, where a person has the charge of a large apiary. In natural swarming one is obliged to yield to their caprices. After days of unpleasant weather, a dozen swarms are liable to issue at the same time, in which case some will double, and often three will light in the same cluster. To separate them, take three hives and place a frame of brood and empty comb in each; this is to pacify the bees. (I will here remark, that when hiving a natural swarm, especially a second swarm, it will pacify them to place in their hive a frame of brood.) Set one hive on each corner of the cloth, with a dipper divide the bees equally among these hives, watch for the queens and cage them; when all the bees are in the different hives set them on their permanent stands. If all the queens were found, liberate one in each hive. After two days examine these new swarms, and the two that have no queens will be building queen cells, and the queen that is at liberty by this time will be laying freely, so there can be no mistaking which swarm she is in. Now liberate the two confined queens, one to each queenless stock.

In introducing queens a few rules are to be observed; one is, no swarm that has a queen will accept another. Be sure that the queen has the same scent of the swarm to which she is to be introduced. This may be accomplished by smoking the swarm with tobacco, or with common "puff ball," or by suspending the caged queen in the hive for thirty-six hours; then remove the cork from one end of the cage, and substitute comb honey, replace the cage, and the bees will soon liberate her.

In artificial swarming, more properly termed dividing, a dozen different ways will naturally be suggested to the experienced apiarian. Many give preference to the nucleus system. My practice has been to lift out one or two central combs from a strong colony, and place them in a hive with comb foundation, remove this strong colony two or three rods and place on a new stand. Set the new hive on the old stand. After two days examine the

old colony, which is now very much reduced in bees; if there are no newly-laid eggs, and they are starting queen cells, it is evident that the queen is in the new stock, where in all cases she should be; otherwise remove the queen from the old stock and give her to the new one. By this method the stocks are doubled in number.

To increase by making only one from *two* old ones, remove all the combs but one from a strong colony, substitute frames filled with comb-foundation; now remove some strong colony to a new stand, and set the hive containing these combs on the stand just vacated. To divide in either of these two ways requires only from three to five minutes, whereas in natural swarming twenty minutes at least are required.

The introduction of moveable comb-hives has made a complete revolution in the interests of bee-culture; it has brought into use the extractor, comb-foundation, sectional frames for surplus honey, and improved shipping boxes, and has given an insight to their habits, and enabled us to settle disputed points which had always been considered doubtful.

Transferring from the common hives to the movable frames should be done in the forepart of the season, after the weather becomes settled. Some prefer the following method: Drive out the bees into a box or old hive, and then transfer the combs, in a tight room. This is the best plan for a novice, as it avoids annoyance from robber bees. In transferring hundreds of stocks, *this* has almost invariably been my method: After getting everything necessary for the operation, a table-knife, pan, a ball of twine, a cloth to spread in front of the empty hive, an ax, and a dish of water, I blow a puff or two of smoke into the entrance, tip back the hive, smoke them a little more, then carefully turn the hive bottom upwards a few feet from its stand, place the new hive on the stand of the old one, immediately split down two sides of the common hive with the ax into two-inch strips; this allows these sides to be easily removed and exposes the comb ready for operations, during which the bees leave the combs and cluster on the opposite side of the hive, and at any time can be brushed off on to the cloth in front of the empty hive; now these combs can be cut in size to just fit the frames, and may be fastened by winding with twine. In transferring the combs to the frames, care should be taken to have the same side up as before; as fast as the frames

are filled, put in the new hive. All these operations, if performed by a novice, should be in the latter part of the day. The whole operation of transferring a stock should not take over twenty minutes. When the bees have fastened the combs to the frames, which will be in a few days, remove the strings, and the bees will join and perfect the pieces of comb.

### PROFITS.

The large returns from the business, when compared with the time and capital employed, have also added stimulus to this enterprise. The profits from my bees for ten years in succession doubled those of the farm. The investment in bees, fixtures, etc., cost a sum not exceeding four hundred dollars, but probably would inventory one thousand dollars. The expense in the care of my apiary—which at this time inventories, on an average, about seventy-five stocks—I should judge was two hundred dollars; interest on the investment at ten per cent., one hundred dollars; then to the credit of the apiary, there was at least three hundred pounds of first quality of honey used in the family each year. Now, the investment in farm and fixtures we will call seven thousand dollars; the cost of carrying on the farm, interest, taxes, etc., can only be estimated, as I dare keep no farm accounts. In the former case, almost any one with a limited capital can build up for themselves a remunerative business; in the latter, it is the work of a life-time.

### WINTERING.

The subject of wintering bees probably has called forth as much comment and criticism as any other connected with bee-keeping. I attribute the great loss of bees in wintering, in a great extent, to the modern hive not being adapted to our cold, northern winters; or in other words, our ignorance in the winter management of bees in these hives. A stock of bees to be in proper condition to meet the emergencies of our long, changeable winters, and cold, backward springs, should have at *least* thirty pounds of honey in such a position in the hive that a large portion of it will be accessible to the bees at all times, as they need. The framed hive has been very deficient in this respect. I have known hundreds of stocks to starve, with frames full of honey on both sides of their cluster which was as inaccessible to them, under the circumstances, as though it had been in the bottom of the sea. In the old-style

hive the bees naturally built their combs irregularly, and any part of the hive was easily accessible from the center. It is a well-known fact that bees fill the top of their hives with honey first and then work down. The result is, that in the fall they are clustered in the bottom part of the hive, their heat rises and warms the combs and honey just above them; this enables the bees in cold weather to gradually move upward to a new supply of stores. During my experiments in wintering, I put a swarm of bees in a hollow log six feet high and four inches thick; the space inside was about eight inches in diameter; the entrance, a squirrel hole, was half the way up; no attention whatever was shown them; each year they sent out a swarm, and that was all the income. After ten years, in order to examine and learn all the facts connected with their wintering, I transferred them, and found just what I had anticipated—their comb built irregularly, and in such a way that every comb was conveniently situated for their winter use; and another thing—I noticed that the cavity was sufficiently large to allow a surplus of old honey, to be kept on hand year after year, in case of need. I do not say that this was economy, but it was a safeguard. The history of this stock helped to confirm theories in connection with the wintering of bees. Hives should have protection in some form during the winter and spring.

The plan I like best for wintering is a dark, dry cellar, with the thermometer at forty-five degrees. When the weather becomes sufficiently warm, set each hive on its old stand, and stimulate by feeding coarse rye flour. The framed hive was formerly built with particular reference to surplus honey, which, with the too free use of the extractor, together with the forcing system for surplus comb-honey, I believe, have been the leading causes of the loss of more bees than all others combined.

The question naturally arises, shall I succeed if I invest? Why is this question applicable to bees more than to farm stock generally—cows, sheep, swine? If you make a failure in any one of these it is attributed at once to some mismanagement; not to your inability, nor to the particular branch in which your experience was a failure. What are you prompted to do but to carefully review, step by step, ascertain the cause of your failure, compare your management with those that have succeeded, gathering all the knowledge and facts that you can, then change your former plan of action, when four times out of five you will succeed. Will

not the same rule apply to bee-culture? You are careful in looking after your farm-stock every day, seeing that they are properly cared for; you are at the expense of feeding them three times each day. How about the bees? Do you give them one tithe the care, expense, and time, in proportion to the capital, and yet expect from them ten times the net profits? If farmers who are novices in apiculture will follow in the main the suggestions that I have briefly offered, the word *failure* will rarely be associated with the business. Some persons will undoubtedly show by love for the calling and enthusiasm in their management that they are especially adapted for the business. Let such go into the scientific part, and adopt the modern hive with its appliances, but exchanging gradually from the common to the framed hives, comparing the results from each; then they will have the experience and knowledge necessary to enable them to act understandingly and with safety. When farmers manage their bees on the same business principles that they do their other farm-stock, then they will fully realize that for pleasure and profit there is no branch of agriculture that will compare with it.

I wish you all success who undertake the business of apiculture, and may your anticipations be fully realized.

The CHAIRMAN. While the lecturer was speaking of the use of a veil for the protection of his face, he was asked how he protected his hands in the removal of a swarm?

Mr. BRADLEY. With a pair of light leather gloves.

Mr. STICKNEY. I have had a great deal of trouble with the moths getting into the hive, and after a while the worms became so numerous that they got the better of the bees. I lost so many swarms, that after trying every remedy, I was obliged to give it up. I wish Mr. Bradley would tell us how we can keep them out of the hive, or exterminate them if they get in.

Mr. BRADLEY. May I inquire what kind of a hive you used?

Mr. STICKNEY. The common, old-fashioned hive, with rods in the center.

Mr. BRADLEY. That is very easily explained. Your hive sent out a swarm during the season, did it not?

Mr. STICKNEY. Yes, sir.

Mr. BRADLEY. When that swarm issued, the old queen went with the swarm. The consequence was, they had no young queen, but they had the means of making one, and, as I stated in the paper I have read, in nine days this young queen hatched out. You might then expect a second swarm, but probably no swarm issued. Now, when the young queen came out of the hive, that is, about three days after hatching, a king bird probably caught her. That left the hive without a queen, and no means of making one, and sometimes, under such circumstances, the bees get discouraged and cease work. The life of a bee in the working season is only a few weeks. Hence they gradually dwindle away, and the moths gathered about the premises, and made the most of it.

Mr. STICKNEY. I would inquire if the moths would not get into a vigorous hive? Or do they always take the weak ones?

Mr. BRADLEY. I never knew a moth to get into a hive with a strong colony. If any do get in, the bees will certainly exterminate them. Sometimes in weak swarms, where the combs cannot be properly protected, they might get in one corner, and do some injury; but if you keep your stock strong, you will have no trouble. The bees will take care of the moths themselves.

Mr. ———. I would like to inquire if bees ever need feeding in winter, and if they can be fed with any benefit?

Mr. BRADLEY. I did not explain the feed system, but the way the feeding system is practiced is, they have a small box above the hive, just room enough for the queen to occupy with her brood of eggs, but for no honey. The bees at once go up to the surplus receptacles and deposit their honey; the consequence is, there is no honey below, and they remove that and put on other boxes; and during the fall the queen ceases laying so many eggs and leaves one or two combs, which the bees fill up with honey. The sections on top are not quite filled, so the apiarist will go and lift out those frames full of honey, shave off the caps, and slip them back again, and the bees will take this honey and carry it right up to the

upper sections, and that will be removed. Now the bees have no honey for winter, or if they have some not a sufficient quantity for the winter. It is absolutely necessary, therefore, that they should be fed in the winter. As I before remarked, a swarm should have thirty pounds. Now this feeder has been invented, one of which can be introduced every day, filled up with sugar instead of honey. It is claimed that this is an economical method, but you see that it requires a good deal of judgment, knowledge, and skill, which it is supposed farmers do not possess, because they will not take the trouble to acquire them.

Mr. WETHERELL. Do the bees make honey, or only gather it?

Mr. BRADLEY. They simply gather it. They will bring in the honey from apple blossoms in the spring of the year, and if you taste that honey, you find it tastes just like the blossoms. Raspberry honey has a flavor peculiar to itself. I think it is the finest flavored honey we have.

Mr. ADAMS of Rockville. I would like to ask a single question on the subject of swarming. I understand by the paper that the rule was, that the bees come out of the hive and alight on a neighboring branch. I wish to ask if that is the rule or the exception?

Mr. BRADLEY. I made general statements; I did not particularize. As a general rule they will go to a bush, or a small tree, by preference. If there are no trees in front of the hive, or near it, by placing some apple tree limbs around, as you would pea brush, they will almost invariably alight on them. Ninety-nine times out of a hundred, they will alight before they leave for other parts. I do not know that I ever had a natural swarm come out and depart without first alighting.

Dr. RIGGS. Did you ever feed glucose?

Mr. BRADLEY. No, sir, I don't recommend it.

Mr. AUGUR. I would like to ask Mr. Bradley to name the plants and trees which furnish the best bee food in the order in which he regards them?

Mr. Bradley. With us, I think the sugar maple blossoms are first to come out. Next (or about the same time) the willow. Then come fruit blossoms, then blackberry and raspberry. Those come out about the same time; I think blackberry a little before the raspberry. Then follow wheat, clover, buckwheat, golden rod, and wild blossoms.

Mr. Augur. How do you regard the flowers of the bass-wood or American linden?

Mr. Bradley. That is one of the most valuable honey-producing trees that we have, but with us they have all been cut down. We have none, but in some parts of the country they have them in abundance. It produces the whitest honey we have.

Mr. Stickney. Is there any danger of getting too many hives in a given locality? having so many that the bees are not able to supply themselves with honey?

Mr. Bradley. I think, at present, there need be no anxiety in regard to that. But if the thing was carried to extremes, there is danger of overstocking; but that regulates itself. If you get a hundred and fifty stocks of bees in a locality that will support only a hundred, they will die off until you get down to the number the country can support.

Mr. Stickney. How can you tell whether a location is fitted for one hundred or a hundred and fifty stocks?

Mr. Bradley. You can very easily tell. If you have the skill and judgment to manage a hundred and fifty stocks of bees, you will have the judgment to tell, without any instruction from other quarters, whether you are overstocked. If you are overstocked, the swarms will not get sufficient honey to winter upon.

Dr. Goodrich. I think your statement was, that fifteen pounds of honey produces one pound of comb. I want to ask you in what manner that comb is manufactured or secreted?

Mr. Bradley. If I understand the gentleman, he wishes to know how wax is manufactured by the bees. The bees are so situated, or have such characteristic gifts (I hardly know

how to express it), that they differ from the animal. An animal secretes fat without any effort on its part. The bees, in all their operations, can perform those operations at will, in the secretion of wax or the manufacture of comb. A certain class of the swarm only are wax producers; they cluster in the hive and are fed with honey in abundance, and that honey goes to fat, or what would be fat in the animal; but in bees, it is a little scale right on the under side of the abdomen—about four little scales on each bee, the size of a small fish scale. That the workers take off and work it over, and in working it over it produces genuine wax. Now, that wax they work into comb.

Mr. Augur. May I ask Mr. Bradley how he regards the Italian bees?

Mr. Bradley. I have tested the Italian bees in a great many ways, and like them very much. One reason is, they have a greater capacity for endurance than the common bees. They are stronger, and they seem to be more vigorous in their labors, working when the common bee does not. As an instance of their strength and powers of endurance, as compared with the common bee, I will mention that I was straining out honey one day, and had a large cloth strainer. When I was through, of course that cloth was saturated with honey. I had two stocks of bees, one Italian, and one common bees, sitting on the same platform, only a short distance apart, and I took this cloth and spread it between those two stocks. The bees at once scented this honey, and they came out from each stock and went on this cloth in about equal numbers. The Italians are very peculiar about one thing—they will not eat with their black brethren; they will drive them away. Well, as they struck this cloth, the Italians coming on one side and the black bees on the other, the black bees at once commenced sucking up this honey. The Italians marched right across the cloth until they met the black bees, and they advanced upon them with confidence; and persons who have seen bees fight can imagine just how the battle was waged. They clinched and wrestled; it was a struggle for life, and

for a small insect, it was very severe. I watched them, I saw that the common bees were getting whipped, and when the battle was over, the Italians went back and took the honey off of this cloth and put it into their hive. Then they came out again and marched right across this platform to the swarm of common bees, and went into the hive in regular soldier style, and the battle commenced again. By that time both swarms had got very much excited, and the Italian bees were coming out by hundreds, and gathering around the stock of common bees. I saw at once that it was becoming a serious matter, and I must stop it. So I closed up the entrance to the hive of the common swarm, shutting the Italian bees in, when they were overpowered by numbers and killed. Then I just opened the entrance a little, to allow one bee in or out at a time, and the black bees carried the day against the Italians. So you see that in this test the Italians were very much stronger, or rather, excelled in fighting capacity, at least, the common bee. I have tested them in other ways, with the same result.

I will remark here, in regard to the queen bee, as I did not explain in my paper that the queen bee is different from the common bee. Any egg that will produce a common bee will produce a queen bee. The common bees are all raised in these cells. In raising an Italian queen, we take out a card, cut it up into pieces, slip them into the little frames, and enclose three frames in a little box just like that. That is a miniature swarm of bees. They have no queen, but they have these eggs, which will produce a queen. So they will start these eggs and raise a queen, and in three weeks the queen is perfected. Now you can take her away and put her in one of these cages with three or four bees, and set that to raising another queen.

Now the Italian bees differ from the common bees in this respect. The common bee it takes three weeks to perfect. The Italian queen bee is fed with a different food from the common bee, and it develops reproducing organs, those organs which are necessary in raising the young, which in a

common working bee are not developed. The common worker lives about six weeks; the Italian queen bee lives for years. There is, however, a difference in every particular between an Italian queen and an Italian worker.

Dr. Goodrich. It is a settled fact that but one queen can occupy a hive at a time. In case two queens become occupants of one hive, I would like to inquire the mode of extermination of one of those queens?

Mr. Bradley. It is the exception to have two queens occupy the same hive at the same time, but it does sometimes happen. When the bees wish to supersede a queen that has grown old, perhaps, they seem to reason it out (if we may call it reason). They are aware of the fact that their queen has become old, and for fear of being left without the means of raising another queen, they will go on and raise their new queen before destroying the old one. I have found the young queen hatched in the comb at the same time the old queen was in the hive, but in a few days the old queen had been destroyed, and the young queen had superseded her. They start a great many queens, and if they choose to throw out a second swarm, three or four queens will go out with the young swarms; but just as soon as the swarm becomes established, the queens fight and destroy each other.

Dr. Goodrich. I had the idea that instead of the bees destroying the queens, the queens themselves came in conflict, and as soon as one got an advantage over the other, she stung and killed her opponent. I was not aware that the bees themselves destroyed a queen, unless in the case to which you refer of an old queen.

Mr. Bradley. In the case of an old queen, I think the bees destroy her. They keep her in prison, and destroy her by closing up her prison, and thus smothering her. You are correct in your statement about queens destroying each other. When two queens are sent out in the same swarm, one destroys the other. They engage in mortal combat, and as they clinch, grapple, and fight, nature has so ordered that only one can be killed. There is one place that they can sting to

kill, and only one can do the stinging at a time. If one gets the advantage, it curls up and gives the fatal sting.

Mr. AUGUR. Do bees puncture the skin of tender fruit at the time of ripening, like the peach and grape?

Mr. BRADLEY. Among fruit men there is a great deal said in regard to bees destroying fruit, but I think it is all falsely laid to the bees. As far as proven—I cannot state this from actual observation, but as far as has been proven, taking reliable statements, the bees use the juice of fruits only after the skin has been punctured or bruised in some way. That is, facts go to show that.

QUESTION. Is there anything in the market that is so near like honey that it is difficult to decide between the real article and the counterfeit.

Mr. BRADLEY. Honey is very much adulterated by dishonest dealers, and the inexperienced are deceived, but you could hardly deceive a person who is handling honey a great deal.

Mr. CHEEVER. I would like to ask a question in connection with that. I see a machine on the table for making what I suppose is foundation comb. I have heard the rumor going around that men have become so ingenious that they can not only make artificial comb, but can fill it with artificial honey, cap it over, and sell it for pure bees' comb.

Mr. BRADLEY. The gentleman very well knows that in order to make newspaper articles interesting it is necessary to get up sensational stories, and I suppose that is one of them.

Mr. WM. L. BURGESS of West Morris, President of the Connecticut Bee-keepers' Association. I will beg leave to say, that two years ago last July my family complained that some very fine peaches were being destroyed by bees. I said, "I shall buy my honey, and preserve the peaches." I went out to the peach trees, and the bees were on the peaches—that was sure. Well, I did not have to put on my glasses to find that the yellow hornet, or yellow wasp, was first puncturing the peaches, and then the bees were gathering around those punctures and sucking the juice from the peaches. I went in and said, "I shall let the bees live awhile longer, and if I can

only find those yellow wasps, I shall save the peaches." I have heard complaints that bees injured fruit, but I believe it is because people do not observe carefully the habits of bees.

Mr. HENRY L. JEFFREY of Woodbury. I have been spoken to several times about the question whether bees would puncture fruit or not. To satisfy myself and many others, I have taken the trouble, not only to watch them, but under the strongest microscope I could obtain. I have examined the mandibles or jaws, not only of the honey bee, but of a number of different wasps. The jaws of the wasp are so shaped that they form, when shut, a point which will cut the skin of the toughest grape, about, that I know of. The jaws of the honey bee, when they come together, are round at the end, and do not possess the cutting qualities of the jaws of the hornet or wasp. They are capable, perhaps, of attacking some very thin decayed fruit skin, and rubbing it until they sever it, but as far as piercing and puncturing is concerned, it is impossible to accuse them, with truth, of doing anything of the kind. These jaws seem to be made in that way more for the purpose of working wax for the manufacture of comb than for the purpose of committing depredations on fruit. They will suck it after it has been punctured. Any person can satisfy himself of that by taking a bunch of grapes and breaking them open, and placing them three or four feet from a hive of bees. He will find, if there is not any honey to be gathered any where else, that the bees will suck the juice completely from those grapes, or from a peach, or any other fruit that contains considerable sugar. But you may take the most delicate fruit that you can find and give them any amount of it, and unless there are some parts of it that are crushed or in some way bruised, they will hardly notice it.

I presume one reason why Mr. Augur asked that question was on account of his being interested in fruit culture. I have received from many other parties who were engaged in fruit culture letters inquiring whether it was probable that the bees could affect fruit. I think the roundness of the edge of the mandible of the bee will satisfy any man that it cannot

pierce the skin of any fruit, like the wasp or hornet. I will appeal to Mr. Bradley whether or not I am correct.

Mr. Bradley. I think the gentleman is correct.

Question. I would like to ask if the honey that is deposited in the comb is the same identical honey that the bees find deposited in the flowers?

Mr. Jeffrey. Any person who has ever extracted honey from the comb, and tasted it in flowers, making it a daily occupation, will have ascertained the fact that honey extracted from the comb, if it has just been secreted by the bee, will retain its flavor the same as you find in the flower; but it is certain the bees exude or separate from the juice taken from a flower an amount of water that would prevent its keeping any length of time.

Mr. ——. That is what I was going to suggest, because, being taken from the fruit, it must undergo some process before they deposit it in the comb.

Mr. Jeffrey. It undergoes a process of separation, that is all.

Dr. Goodrich. There is one point that has not been mentioned, that I would like to have explained or brought out. We hear in bee culture of what is called "the honey dew." I would like to inquire what it is? What produces it? Also, if there is any difference in different plants in the production of that "honey dew"?

Mr. Jeffrey. I believe that "honey dew" has been decided, by the majority of bee experts and entomologists, to be the secretion exuded by a species of louse that infests vegetation.

Mr. Gold. The question does not appear to have been answered to perfect satisfaction, whether the honey is subjected to any change when it is taken from the flower before it is deposited in the cell. It has been answered that it is not subjected to any change. When a bee eats a sweet grape, what does it do with it? Does it use the juice of that grape for honey, or does it use it for food?

Mr. Jeffrey. The juice of that grape is deposited ex-

actly the same as the juice from a flower. It has a certain amount of water that the bees always separate from it. It is separated in going through the honey sac, and the juice is then deposited the same as honey gathered from a flower.

Mr. GOLD. That does not quite answer the question. We admit that the honey possesses the peculiar aroma of the plant from which it is extracted; but the bee takes the juice of the grape, which is not honey, by any means, and, as you say, after depriving it of a portion of its water, deposits it in the cell, and then it is honey. What is done with the acid properties of the grape? That is not quite clear to my mind.

Mr. JEFFREY. If that juice is extracted from the comb, and that extract subjected to the same treatment that it would go through for making wine, it will contain its fermenting properties, which show the presence of acid just as much as if squeezed right from the grape. My reason for saying that is, that in 1878 I had three or four stocks of bees from which I had extracted the honey. There were some apples lying in a pile not over fifty feet from the hives, and the bees worked on those apples very industriously. I extracted the juice from the combs, gave it a chance to ferment, and it fermented just the same as apple juice from the cider press.

Mr. BURGESS. May I make one suggestion? We should remember that the bees use the saccharine or sugary part of vegetation only. I think some of us forget that fact when we ask this question,—that bees do not like the acidulous qualities of vegetation as they do the sugar.

Dr. RIGGS. I would like to inquire if the Italian bee is able to take the honey from the red clover? I have heard it stated that it could not.

Mr. JEFFREY. To answer that question, I will give you a statement from a gentleman who never saw an Italian bee until this season. His name is William R. Keeler of Bantam, Conn. There was a stock of Italian bees taken to his place some time in June, this year. He was sick at that time, but as soon as he became convalescent he went out to a clover

patch back of his barn, and said he would find out whether Italian bees got honey from clover or not. He took a sheet of note paper with him, and drew a line down the centre of it—on one side he marked "Italian," on the other, "Black." When he came in, he had got the paper full of marks, where he had set down every bee that he saw, and there were just eleven Italians to one black bee found on the large and small heads of red clover.

Mr. BURGESS, President of Connecticut Bee-keepers Association. I would invite all members of the association, and all others interested in bees, to remain after the adjournment for further discussion.

Mr. AUGUR. I would like to make one suggestion. At the opening of these meetings, we had a description of the Storrs Agricultural School. It has occurred to me, and I would like to suggest to the directors of that school, whether a colony of bees at the school might not enable the students to study their habits, and be a desirable addition!

Adjourned to evening.

## EVENING SESSION.

The meeting was called to order at seven and a half o'clock, by Vice-President BARSTOW.

The PRESIDENT. Ladies and Gentlemen,—I have the pleasure of introducing to you, as the lecturer this evening, a gentleman of world-wide reputation as a dairy farmer, Maj. HENRY E. ALVORD, of Houghton Farm, Mountainville, N. Y.

Maj. ALVORD. It is plainly my duty at the outset to express my appreciation of the large audience here present, and at the same time I am obliged to feel that numbers of you may be disappointed this evening, for the reason that this audience has gathered under a programme announcing as the speaker of this evening a gentleman with whom you are much more familiar than with me. This is an audience gathered for Mr. Olcott, that I have the honor and pleasure of addressing. I want at least to express my appreciation of

his kindness and that of Secretary Gold in making an exchange in the programme for my personal accommodation, and also to express regret in case of any disappointment that may arise in the audience therefrom.

## THE FARMER AND HIS FAMILY.

By Henry E. Alvord, of Houghton Farm, New York.

From the very nature of existence, the greater part of the human race are, and must ever be, engaged in the pursuit of agriculture. Producing the necessaries of life on and from the soil, its tillers must provide not only for their own families but for the rest of mankind, otherwise employed. The producers exceed the non-producing consumers in every portion of the globe. If we seek the greatest good of the greatest number, there can be no better subject for study, with a view to progressive improvement, than is presented in that social and industrial unit of which there exists more than any other,—The Farmer and his Family.

This especially applies to our own country, where agriculture is the leading and permanent industry of the people. This meeting, and meetings like this, attest the importance attached to this great interest and necessarily to those in whose keeping it lies. There is universal recognition of the fact of universal dependence upon farms and farming, and the higher the civilization the greater this dependence. The products of agriculture form the elements of nearly every kind of business in the whole range of society. We may annually witness the anxiety with which bankers and merchants, manufacturers and the great transportation companies, watch the progress of harvest. Good crops mean good times, bad seasons, hard times. With the blessing of Heaven and bountiful harvests, the whole business life of the nation is quickened.

History teaches that where a people have devoted themselves to a progressive agriculture, they have been uniformly prosperous, while those nations which have abandoned, or even neglected it, have declined. Many examples might be cited of great statesmen in all ages, who have recognized the lessons of history and endeavored to impress them upon the policy of their times.

Recalling these facts, it seems impossible that agriculture should ever be held in low estimation. Yet in spite of the accumulation of the evidence, persons in all other departments of labor, although dependent therein upon agriculture, are wont to speak of it in terms of indifference and derision. Worse still, and shame upon it! farmers themselves sometimes seem to feel ashamed that they are farmers. They may often be heard to express a great distaste for their occupation and a determination to train their children to other pursuits. And those whose early life was spent upon the farm, but who have entered other paths, too soon forget that they owe the sound body and clear mind, which make life a success, to the old farm home, and are too ready to treat with disparagement, if not contempt, the noble calling of father and mother, to which they really owe their own strong foundation.

Unfortunately, this seems to be particularly true, here in New England. It is not so everywhere. In Great Britain, no matter what may be his wealth, rank, or occupation, no man feels quite content until he is the owner of agricultural land. The same is true in a great measure in the southern part of this country; professional men and merchants there very generally live upon their own farms, and to be a good farmer is a sure pass to the best society. Here in the East, on the contrary, you plainly see that the corner groceryman, railway brakeman, mechanic, and briefless lawyer, to say nothing of the ministers and the teachers, think themselves quite superior to the farmers, both in their occupations and in the social scale. And the great trouble is, that farmers themselves, by silence and failure to assert themselves, allow this opinion to prevail, and practically agree to it.

It is true, there is nothing in the present surroundings to call forth such remarks. Here and now agriculture is foremost, and if all the sneerers at farming could be brought to the Connecticut Farmers' Conventions annually, they might be converted. On such occasions, as well as in their other special gatherings and exhibitions, our farmers are true to themselves, and the just pride in their calling and work shines forth. But such are bright spots in the year, and you must admit that when scattered upon their several farms, and mingling with people in other pursuits, the position of New England farmers, as just described, is but too true! We are considering the condition and duties of the farmer, not on exceptional days, but as existing 365 days in the year. So

regarded, the weakest point in the farmer and farming of to-day is this apparent lack of self-respect and self assertion, not personally, but as a farmer and for farming. Hence the first duty the farmer owes to himself, and his family, is to correct this weakness.

Let me appeal to you here present and to all engaged in agriculture, to carry with you, wherever you may be, throughout the year, the same honest and honorable pride which to-day is manifest. Maintain the dignity of your calling, teach your children to respect it and to love it, and help, in every way, to raise the conditions and business of agriculture to its proper position in the estimation of all.

It rests mainly with farmers themselves, their wives and children, to raise their vocation and the position of all engaged in it, to the highest rank among the pursuits of man. If they desire to see it duly honored they must honor it themselves. If they wish to see others engage in farming, they must on no account evince an aversion to it. If farmers would have their sons place a just appreciation upon agriculture, they must do their part to make the occupation more honorable as well as more lucrative. To accomplish these ends, the chief requirements are that farmers shall properly prepare themselves and their families for the business, and shall fully and actively perform all their duties at home and among their fellow men.

The power for good, of the farmers of this country, is nowhere so potent as in their broad relations as citizens. The men from the farm should take more general and active, and, when necessary, more united participation in public affairs, and thus make themselves a power in the body politic. They are strong enough numerically, forming a full half of the voting population of the United States. They only need to act, sometimes independently and sometimes together, to exert the greatest influence for good.

Every American, by birth or by adoption, acquires not only the privileges of citizenship, but must accept therewith corresponding obligations. The duties of the citizen cannot be honorably neglected; his responsibilities can never be escaped. The good citizen must watch the public interests day by day, for they are his own. He must bear in mind that the moral law applies just as fully to political life and action, as to social and business life. There may be sins of omission as well as sins of commission. If he expects to enjoy the blessings of good government, he must give earnest

and constant attention to his duties as a citizen. This is the *condition* on which he holds his rights.

It is very necessary that citizens of the agricultural communities should be alert in these duties, in order to counteract the evil tendencies of the great cities. The collection of very large populations in commercial centers is one of the serious problems of the day. It is in these great cities that rings, strikes, frauds, trades-unions, socialism, centralization and political corruption, crime, and immorality are born, fostered, and best flourish. In agricultural districts—with some unfortunate exceptions—the tendency is in the opposite direction; the people are there, as a rule, devoted to peace, justice, and good order.

The trouble is and has been that in the great centers of population the rabble is found active, aggressive, and working as a unit, while in the country there is less interest and activity in public affairs. As a result, our agricultural districts are not the power they ought to be and might be made. It is for our farmers to change this—first by a careful study of all the great questions of public policy, that their judgment may be deliberately formed, to guide intelligent action—and then by increased activity and decisive action.

Farmers constitute the reserve forces of conservatism under all governments, particularly our own. Let them come to the front now, as they did in the early days of the Republic; for our liberties were conquered by farmers, and farmers largely framed our organic laws, local and State, and framed the national constitution.

A narrower but hardly less important field of usefulness is that of the locality or neighborhood. Every farm family has many opportunities for making its own locality attractive and improving in various ways. Much can be done towards enlivening and elevating the social life of the neighborhood. Every farmer should be a good neighbor. "The Golden Rule" is nowhere more applicable or more fruitful than in the country. It is the duty of all to take an honest pride in their own locality, village, and town; to join heartily in all real and sensible improvements looking towards the comfort, health, and happiness of the community. Be public-spirited. Do your full part toward maintaining good schools and good roads. All these things cost money, in the form of taxes or otherwise. But they should not be regarded as burdens; they are, rather, the safest and most productive of investments. A local

lyceum or debating society, a grange or farmers' club in some form, and of a semi social character, is always beneficial to young and old. The nearest agricultural society should be heartily supported by every farmer, and as much by the owner of one cow or the cultivator of a few acres as by the largest farmer. And not only one, but several members of the farmer's family should contribute to the periodical gatherings and exhibitions, no matter how humbly. Remember the parable of the Talents!

Beside this increased activity in the affairs of men—which would make our farmers a positive and recognized force in society, business, and politics, and which they owe to their country as well as to themselves—we place as equally imperative, their duties as fathers of families in rearing *men* worthy to succeed them.

New England country homes are generally blessed by goodly numbers, and well it is; for they are the source from which is drawn the supply of fresh blood necessary to the life of all human pursuits.

Even if it were deemed desirable, it is manifest that all reared upon farms cannot remain engaged in agriculture; there is not room for all. The farms in Connecticut have increased in number during the last ten years from 25,000 to 31,000—relatively a greater increase than in the population of the State. And it is doubtless true that a further reduction in size and addition to the number of farms, to 40,000 or more, may be advantageously made, providing farm-homes for four families in the next generation where there are now but three. It still remains true that there must be a surplus of farmers' boys. These go everywhere, and the beginning made in body and mind and morals, at the farm-home, is found to be the very best foundation on which to build a successful career in every department of industry. A remarkable example of this was published not long ago by an eminent clergyman in a New England city. He made up a long list of prominent citizens and successful professional and business men and traced them to the homes of their childhood and found that *nearly all* began life upon the farm. Then tracing the same number of sons of wealthy and prosperous men in cities and towns, in the same generation, he found that a very small percentage of these ever reached positions of eminence.

The fathers and mothers who are at the heads of the farm-homes of America must therefore bear in mind that they are lay-

ing the foundations, in body and in character, not only of their successors in their own calling, but of the future leaders in almost all the walks of life. The great responsibility thus resting upon them cannot be too forcibly expressed or too keenly appreciated.

In handling a crop of corn, we send to market only merchantable ears; but all sound corn, and even some soft ears, may serve varied and useful purposes. The little nubbins, if properly treated, may make the best of bread. We are taught, however, that in good husbandry, to secure a perpetuation of the species and obtain a profitable crop, the very best and most perfectly-formed ears should be selected, at an early period of their growth, and saved for seed.

The farmer and his family are essentially the seed-corn of our land. It is of vital importance to make such selections as shall reserve the very best for agriculture and thus improve, generation after generation, the purity and quality of these fountain-heads of supply, the farm-homes of the country.

Unfortunately, the general practice in this particular is exactly the opposite of what it ought to be. Parents make heroic efforts and show much self sacrifice in educating sons and daughters *off* the farm, but it is a rare thing to see the same exertions put forth to specially educate their children *for* the farm, so that they may enjoy agricultural life, be successful in it, and profit by it.

One reason why farming has been held in such low estimation, is the idea which has so largely prevailed, that anyone can be a farmer. Many seem to think that from instinct alone, and without education or the aid of science, one can perform all that is necessary in that employment, and that success depends mainly on the amount of physical labor expended. Hence it has been too much the practice that when a person of ingenuity or fond of research—a youth of promise and eager for distinction—has appeared in the ranks of farmers, his attention has been immediately turned away from agriculture to some other field.

The boy with an inclination for study and a taste for knowledge, instead of being provided with an education to render him peculiarly useful on the farm, not only by applying science to its operations, but also by enlightening his father and brothers in this and other branches of useful learning, is at once exiled from the homestead and put in training for one of what are called the "learned" professions,—and despite the fact that all of these are over-

crowded. Or if not a born student, but yet of superior address and enterprise, the boy goes to a commercial college and to the city to be trained as a merchant. Another, that evinces unusual genius in the construction of things, is fitted to be an artisan. And so it is that the boys kept at home for a supposed lack of talents are doomed to work upon the farm, with comparatively few educational advantages.

Such a policy operates to deprive the farming community of its best talents, and in doing this to prevent elevation of character and success in the development of rural resources. The favored boys learn to despise the occupation of their fathers and feel it is an employment unworthy of them. Those destined to it feel correspondingly degraded, and are apt to conclude that nothing but brute force is needed in the performance of their duties.

How can agriculture be expected to win its rightful place, while such practices prevail to any extent? and this picture is not overdrawn.

Let me use a homely but a just comparison. How long could live stock be kept at a profit, if the very best were continually sold and only the ordinary animals kept for foundation stock? In short, how long could our New England cattle shows be maintained if we bred our cattle as we breed farmers?

Farming is the well-spring of our national prosperity, but to keep up the race of thrifty and progressive farmers this process must be completely reversed! The best stock in the farmers' family must be kept upon the farm and given every advantage to progress.

Where is there an occupation which so constantly deals with the subtle mysteries of nature and so much needs all the light of modern science in its aid, as that of the farmer?

Where is the business which needs a closer watch of the markets and greater tact in buying and selling?

Where is the trade or manufacture that requires more skill and a keener appreciation of labor-saving appliances?

Farming in the older states is not the thing it used to be. Times have changed. On every side a higher standard of education and technical training is now required. American farmers of the present day, although feeling the lack of early advantages, are a reading and thinking class. They are the last men to "call" a minister not a scholar and theologian, and they insist upon family

physicians of thorough medical education. Even the neighborhood "cow doctor," so long an oracle in the rural districts, has lost his prestige, and the intelligent owners of valuable domestic animals seek the services of a regularly-educated veterinarian. Men endeavor to give their sons a better preparation for their chosen calling than they themselves received. I know a skillful dentist, whose practice is extended and lucrative, and who "picked up" all he knows of his profession; but the sons, intended to succeed him in business, are given a liberal education, completed by a course at the best dental college. In agriculture it is the same, although farmers are the last to realize the change in regard to their own calling. They are a most conservative class, and but just beginning to apply to themselves and their children the lessons of the world's progress.

When this was a new country, upon virgin soil, holding the stored fertility of ages, a maximum of muscle and a minimum of brains produced a generous living on the farm. Not so, now. The conditions of agriculture upon the greater part of our farms have so changed that a minimum of muscle and a maximum of brains is the requisite for a successful and progressive farmer. This necessitates a new and higher course of training; a higher education is needed to fit one for farming as a business.

The farmer must apply to himself, and to the son or sons to succeed him, a standard similar to that by which he measures the qualifications of his doctor and his minister. It is unfortunate that farmers are so slow in doing this. No one ever heard of a physician fresh from his schools and books being sneered at as a "book-doctor." On the contrary, all doctors without a complement of book-learning, scientific training, are shunned and denominated "quacks." Yet very recently it was common for farmers of the olden style to look with pity, if not suspicion, upon those who studied agriculture as a science and undertook its practice with a progressive spirit, and to call such "book-farmers." Happily such errors are passing away; book-farmers, well educated farmers, are making themselves felt; winning respect and finding an appreciation of their enterprise. Let us hope the time is not distant when book-farmers, in the best sense, shall be in the majority. Then, perhaps, "quacks" will be found in farming. The fact is, at present, quack-farmers are too plenty and book-farmers too few.

Book-farming, in its truest sense, is only making use, in addition to one's own experience, of the experience of others, as recorded by them on the printed page. And these others are often men who have been able to give much more time to the study and practice of special branches of agriculture than it will ever be possible for us to do. If the books be only on subjects where we need light, and their authors known as competent to give it, the more we have within reach, and the more we study them, the greater becomes our store of *experience*, of that experimental knowledge which, whether of our own obtaining or procured from others, is so necessary in guiding our footsteps, every day we live.

In every farmer's home there should be good books on the various branches of scientific and practical agriculture, which give us the benefit of established facts; and good periodical journals and newspapers should be coming in, to bring the latest intelligence and experience in all farming operations.

More important still, a *taste* for this class of useful reading should be cultivated by the farmer himself and formed in his family by precept and example, to the exclusion of the raft of stuff which goes under the name of literature, but which serves only to assist in wasting precious hours.

A demand has arisen, and is increasing, for a higher education for farmers, and the next question is, of what shall it consist? When one comes to consider or describe a comprehensive agricultural education, a big subject is presented. Agriculture is at once a science and an art. "Practice with Science" is, therefore, a good precept for its student, and it is well to keep fresh Davy's excellent definition of science, as "refined common sense." The educated farmer must be able to keep pace with the advance of modern science and discern wherein its developments may be brought to his aid. He should be a better chemist than his doctor or his druggist, a better botanist than either, and should be acquainted with geology, mineralogy, entomology, and somewhat with meteorology. He should be as good a business man as his grocer or his banker; especially he must know how to buy and to sell. He must understand the physical powers, know the value and strength of materials, and be a pretty good mechanic, if not an engineer. He should be able to do plane surveying and leveling and to manage a microscope. The usefulness of Latin,

elementary at least, as an aid to the study of natural history, is well appreciated, and America is still so slow in scientific matters that the ability to read French and German adds much to one's capacity in this line of study. (This sentence should be read again, that it be not misleading: a good mechanic may successfully follow his trade without a certain expensive tool, of only occasional use; yet he likes to have it in his chest, and if within reach he at times finds it of great assistance.) A farmer needs as accurate knowledge of anatomy and physiology as a physician, though it be in a different and wider field; he needs to be something of a lawyer, to know what trees he may cut and when he may shoot a woodchuck or take a trout, on his own farm,—and he needs a fair share of his minister's theology and faith, to fully appreciate the mysteries and the beauties of creation, the grandeur of Nature and natural laws, and to truly love and honor the vocation which, above all others, brings man into close communion with God. In short, it is safe to assert that no human occupation requires so long a course and wide a range of study, to comprehensively fit a person for its intelligent and profitable pursuit, as agriculture. There is, besides, the necessity of practice, or the apprenticeship part of learning the art.

This presentation of the subject should not discourage nor alarm. There are partial courses and short cuts to successful special farming, as well as to the bar and the pulpit. A half loaf is better than no bread, and in some cases does as well as a whole one. We are not considering the training needed to make a plowman, or a teamster, a mower, or milker or ditcher, but the making of a farmer, in the broadest sense. Education requiring time and money, and ambition and brains, solid, substantial study and drill, will be meat and bread to the farmers of the next century, and of these many are now alive.

If the question anywhere arises which of three boys on a farm shall be given the advantages of a collegiate or technical education, the one who is to be a professional man, the one who is to go into business, or the one who is to be a farmer, there is no sort of question in my mind that the future farmer is the one who needs special education the most, and a good agricultural school or college is the place to get most of it. The farmers of Connecticut, although fortunate in the possession of a well-established and ably-conducted Experiment Station, have an agricultural college

only in name, from the lack of patronage. But you have an excellent agricultural school in your midst, almost unique, and within easy reach are the agricultural colleges of other States. These institutions the farmers of the present day cannot afford to neglect. Specially deserving the support and patronage of farmers, and peculiarly pleasant and profitable places for the sons of farmers to study, they are not exclusively for the education of farmers, by any means. Think of the many occupations closely related to agriculture, to follow which with intelligence those engaging in them need to be well acquainted with all farming interests.

It is the height of folly to object to agricultural colleges and schools because among their graduates are found some who never engage in farming. This is a direct benefit to agriculture, in scattering through all the varied pursuits of life men who know what agriculture is and what it needs.

The numerous classical colleges and professional schools have been expressly founded and directed to educate men away from the farm—turn them into other pursuits—and so thoroughly have they done this work, that among their graduates few will be found to acknowledge having any interest in agriculture, or any acquaintance with it. On the contrary, the agricultural colleges, although not founded solely to make farmers, certainly do educate towards the farm, and wherever you find one of their graduates, whatever may be his employment or position, you are sure to find a *friend* of farmers and all farming. And let me say that, next to the right bearing of farmers themselves, the thing most needed by agriculture to-day, to raise it to the place it ought to hold in the estimation of all, is the true friendship and active sympathy with our great farming interests, of those who are engaged in *other* pursuits.

When the question is raised how farmers are to provide themselves and their children with any considerable part of the education indicated, a new field for discussion is opened, manifestly too wide to be gone over in this paper. Only a few hints can be given. The farmers of the present generation can do much toward making up for the lack of opportunities in the past by availing themselves of those of the present. They should first work less and read and think more. It pays to "hire hands" and save a head, on a farm. Make time, too, by a free use of the best labor-saving implements, and devote the time saved to reading more of the agricultural and

general literature of the day, watching and studying the work of private and public experimenters in agriculture, attending lectures and meetings within reach which bear upon farming or relate to the public welfare. As for the children, the step of first importance is to teach every one, from the beginning, that an education is an essential part of living. The habits and powers of observation and manipulation—invaluable adjuncts to any practical education—may be cultivated at home; nowhere better than on a farm. But as the intellectual training will require absence from home and cost money, a school-fund should be begun for every child as soon as it is old enough to know what money is (or sooner), and the child should be taught and assisted to contribute. Give the girl some poultry, or bees, or small fruits to care for and own, with their increase and profits. These and other farm departments require labor and thought well suited to the girls. Give the boy a calf, a pig, or a sheep, or an acre of land for his own, and in time make him a partner on the farm, securing to him the fruits of his labor. The parents must help, of course, but by some such systematic effort people of very moderate means may provide, in successive years, funds ample to start sons and daughters on a course of higher education than most agricultural neighborhoods can supply. And if only started, or helped along, instead of having all expenses paid—thus forcing the student to help himself to some extent—all the better. Almost every educational institution now affords, of itself or in its vicinity, means of partial support for some students. And the education which a boy or girl secures by their own exertions, is the kind that wears the best. The will is first needed, in parents and child,—" Where there's a will, there's a way."

The subject of self-education and the education of the family at home, in the home circle, by reading and discussion, already alluded to, might be further dwelt upon with profit. Much more can be done in this direction, at the farm-house, than is often attempted or even conceived. The farm itself is an educator, in all its operations and in its varied scenes, if only the faculties be trained to receive its lessons. The breaking ground and sprouting seed, the budding trees and falling leaves, the skies and clouds, and the different domestic animals, may all be made to stimulate and develop the intellectual powers.

In the farmer's household there is usually room for aid and im-

provement by lessening the labors of the family and adding to the attractions and amusements of the domestic circle. I do not refer to painting and piano-playing, to silks and satins, not to fine buggies and fast trotters, but to things more substantial and ennobling.

Much has been done for the men on the farm, during the last century, to lighten their toil and multiply their power. We need only mention the changes that have been wrought in mowing and raking, loading and unloading; in plowing and sowing, reaping, binding, threshing, and winnowing; and so we might go on. But now think how little, comparatively, has been done for the women. Some years ago there was a movement which banished the loom and the wheel. That was good, even if our clothes don't wear as well; but then came a long pause. Years passed, and the sewing-machine was introduced—another great advance. But now a still longer pause. Should there not be another forward movement? The old adage is still true:

> "Man's work is from sun to sun,
> But woman's work is never done."

So long as this can be quoted as fact, it is a reproach to our boasted civilization. We hear much talk about the difficulty in keeping the boys on the farm. Now I don't believe the boys on our New England farms shrink from the honest toil that falls to their lot. But when they see the drudge, drudge! drudge!! to which their mothers and sisters and sweet-hearts are often subjected, they are led to resolve that when they come to man's estate their occupation shall be such as not to make their loved ones so much like beasts of burden.

Before farmers generally ride on their plows and milk by steam machinery, let them give the folks in the house another lift. There is ample opportunity, and although we cannot now discuss measures of relief in detail, we may mention, as promising "leads," the substitution of milk sales and co-operative butter-making for home dairying, and the possibilities of the co-operative laundry.

Do all we can to lighten the labors of the day, in the house and out of it, there will still remain work enough for all, upon the farm. We never need fear getting rid of too much work, or avoiding the necessity of training every member of the farmer's family to manual labor.

While physical labor and industrious habits are matters of importance, to be taught to all sons and daughters, they should never be permitted to interfere with or dwarf that mental and moral culture which is essential to perfect manhood and womanhood. Something besides hands are necessary on the farm; and the busy world outside of agriculture, which looks to the farm for its recruits, demands not only hands, but brains and character.

Then let the children and the young people on the farm be taught aright, and every possible step be taken to give them broad, liberal, progressive training. Let all be impressed with the greatness and the importance of agriculture, the dignity of the calling, and the need of studying to procure its enlightened advancement. Let them be taught that whatever their lot, they can never find a more honorable, healthful, or healthfully profitable employment, nor a more useful sphere than that of their fathers and mothers, and especially that there is no other calling in which mortals can live so near to the God of all life.

Young men especially should be encouraged and assisted to inform themselves as to the affairs of business in the world at large, and to acquaint themselves with those matters of public morality and general policy upon which depend the happiness and welfare of the whole people.

Thus will all who are reared upon the farm, those who remain and also those who go to fill positions of usefulness and responsibility in every sphere of life, be fitted to perform the duties of citizenship and to act with wisdom in regard to public affairs.

Those who continue in agriculture will be thus, in turn, prepared to rear another generation in the same wise course, and themselves be influential in winning to the farming interests friendship and support everywhere.

This alone is necessary to place foremost in their relations to business, foremost as a power in the affairs of State, and foremost in society, The Farmer and his Family, who have in their keeping the mainspring of our country's prosperity—the Agriculture of America.

The PRESIDENT. Among the many good things which Maj. Alvord has told us this evening, he spoke of the influence that the farmer had, and it called to my mind a little experience that I have had within the last few years. Being called

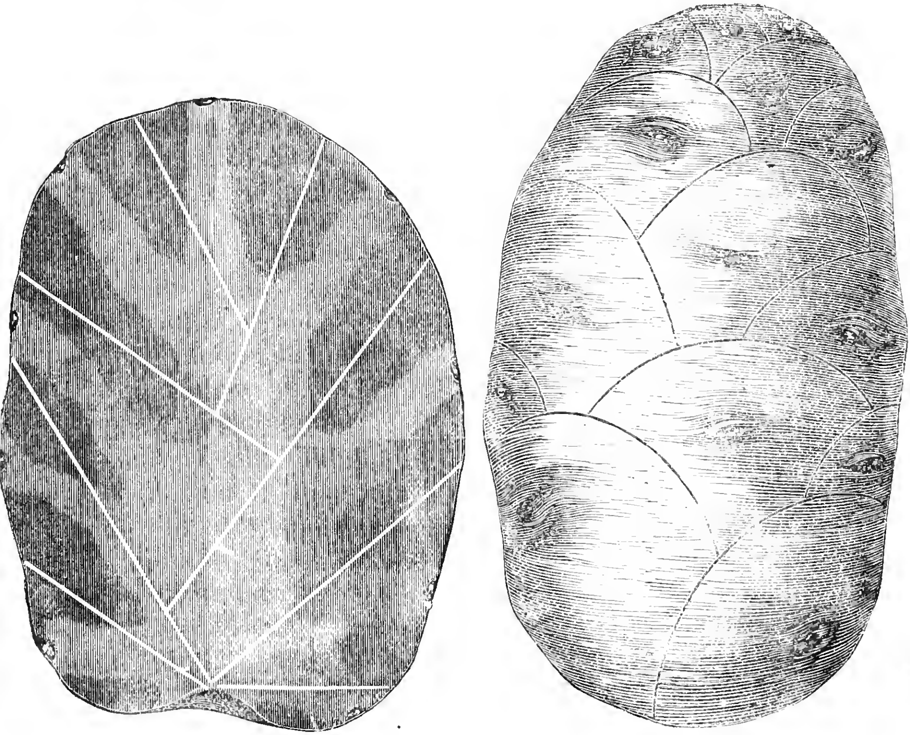
to a position a few years ago where it became my duty and pleasure to seek to get some legislation for the benefit of the farmers of the State of Connecticut, I found that when the committees reported in favor of any measure, on taking it before the House of Representatives I could rely in almost every case upon the support of the lawyer, of the doctor, of the mechanic, of the manufacturer, but there was great doubt about how the farmers would vote when the question came to be acted upon. There are hundreds of men who are sent to the Connecticut Legislature as farmers, and nine out of ten will vote against every proposition to benefit the farmers of the State. They will vote hundreds of thousands of dollars for the military, or any other object that comes up, but if they are asked to vote a dollar for the benefit of agriculture, they will not do it.

If any gentleman has any question to ask Maj. Alvord, he will be most happy, I have no doubt, to answer. If there is no question, perhaps some gentleman will favor us with some remarks. We have a few moments before we adjourn.

Dr. Sturtevant. I propose, in a very few words, to give you the result of a few studies upon the potato which appear to have, as far as our investigation goes, a very important practical bearing upon the cultivation of that article.

If a potato be cut, there will be found running through the center an appearance of structure, which may be represented by a central band of fibres, each connected by lines with all the others in the potato. [Dr. S. made a sketch upon the blackboard showing the lines and fibres of which he spoke.] By cutting a potato longitudinally, you will see these lines brought out in different parts of the potato, and it will also be seen that those lines have a distinct direction in the potato. I will not dwell upon that, but simply state that, in our experiments, when the potato was cut across those lines, without going down to the center, the crop was inferior to the crop where the cut included those lines clear down to the center. The point is, that in cutting, it is necessary to include this branch-like appearance which runs down into the potato.

[To illustrate his point, Dr. S. cut a potato, taking out each eye in a wedge-shaped piece; but the method of cutting cannot be made intelligible in print without the use of diagrams. He said that by this method of cutting, a saving of from five to seven bushels of seed to the acre would be effected over the ordinary cutting into half and quarter pieces, while, at the same time, a very large increase of crop would be obtained.]



This cut is furnished by the courtesy of Hiram Sibley & Co., Seedsmen, of Rochester, N. Y.

QUESTION. What do you do with the seed end?

Dr. STURTEVANT. I usually leave that, simply because cutting it small it is difficult to get the seed started. But if you want to plant that, in garden culture, that is probably just

as good as any other part of the potato, as far as our experiments have gone.

Adjourned to Friday.

## THIRD DAY.

FRIDAY, Dec. 15th.

The Convention was called to order at 10.30, Hon. ALBERT DAY of Brooklyn in the Chair.

The CHAIRMAN. I have the pleasure of introducing to you Dr. GEORGE A. BOWEN of Woodstock, a gentleman who finds time to practice his profession, and to devote considerable attention to the cultivation of a fine farm, and the rearing of excellent stock; a gentleman who, I know, is a practical farmer, a good physician, and one who knows whereof he treats.

## THE VENTILATION OF FARM BUILDINGS.

DR. GEORGE AUSTIN BOWEN, WOODSTOCK.

*Mr. Chairman, Ladies and Gentlemen:*

At the first thought it would seem to most persons that this subject was of too trifling an order to occupy the attention of a convention of this character. But from an extensive acquaintance with the nature of the farm buildings throughout the State, I am led to believe that it is not only a very necessary one, but one that the circumstances of the market, the drift of sanitary intelligence, and the sentiments of the times will in the near future compel us to investigate. It is beginning to be mooted abroad, and if there is anything in it, it becomes our character as business men, as well as scientific men to inquire into its claims.

When the young animal is first ushered into the world, there comes a convulsive struggle to fill its lungs with air. The lung-cells expand, the air rushes in, and at once commences a new life by the oxidation of the blood, which has heretofore been elaborated through the system of its mother. It can exist a goodly length of time without food, but for its whole life pure air must be unceasingly supplied; should it be shut off but for a limited space,

its life would cease to exist. Pure air is its life; a vitiated air is akin to no air at all, therefore akin to death. How necessary, then, for us to study the subject thoroughly, for during a long period of the year the severity of our climate compels us to house our animals, not only to secure their comfort, but for the convenience of feeding and giving suitable care, and most essentially from a point of economy.

Where stock roam at large almost in a condition of nature, and where farm buildings are a series of half-open sheds, and on many of our New England farms, where barns have more the appearance of bird-cages, so wide are the cracks between the boards, an inquiry like ours would be unwarrantable, for ventilation is possessed to an extreme degree, and the contrary question of shutting off the supply of air would be more pertinent to the farmer's mind and pocket. But agriculture is rapidly advancing. The capabilities of our land and stock are being everywhere demonstrated. A more careful and saving system is coming into vogue. Better buildings are one of the leading essentials of this new system, and in these new buildings we cause our stock to lead more artificial lives, because we find therein more profit. It is not our desire to make their lives artificial; circumstances compel us to do so, our aim being to make them as natural as possible.

To the full understanding of this question we must study the first requisite of a natural life—a pure, unvitiated atmosphere. Of what does this consist, and what influence does it exert upon animal life?

Our earth is surrounded by an atmosphere of air, supposed to be at least forty-five miles in height, and perhaps much farther than this, but in an extremely attenuated condition. One hundred cubic inches of it weigh at the mean temperature and pressure very nearly thirty-one grains. It presses upon the earth at the level of the sea with a weight equal in round numbers to fifteen pounds upon every square inch of surface. Owing to physical causes it is ever in motion, either as a gentle breeze, a swift wind, or the destructive and terrible tornado. Although invisible to us, it is so familiar as to be regarded with but little curiosity or attention; yet in it we find the means of life. The ancients classed it as one of the four great principles of nature—earth, fire, water, and air; we have learned to look for subdivisions, and we find that air

is not a purely elementary substance—one by itself—but that it is composed of other materials, in fact a mixture of gases and matter, each of which holds an individual relationship towards animal and vegetable life. We find that nearly the whole bulk of it is oxygen and nitrogen, and are in the habit of speaking of it as composed of these two gases; but we also find as regular components carbonic acid and watery vapor.

These four substances the air everywhere and always contains, and in very nearly the same proportions. Gay Lussac examined air taken from an altitude of nearly four miles from the earth's surface, and compared it with that from the summit of the Alps, and from deep valleys, and found it to be sensibly the same. The exact and numerous experiments of other analysts have shown the same results.

Besides these four components there are found traces of ammonia, sulphuretted hydrogen, and carburetted hydrogen, but they are very varying and too small for estimation, and we leave them out entirely in our review of the chemical composition of the air.

Oxygen is an elementary substance; that is, it has never been decomposed; it is a gas without color, taste, or smell. We always speak of it as a gas, but when compressed with a force of three hundred atmospheres and cooled to a low degree it becomes a liquid. Animals breathe in it with a great sense of exhilaration and excitement; it increases the circulation, produces fever and finally death. They live too rapidly in pure oxygen, and burn away as in all processes of combustion. When a lighted candle is introduced into it, the flame at once becomes more brilliant and it is rapidly consumed.

This gas is easily prepared by mixing an ounce of the chlorate of potash with fifty grains of the oxide of iron, or black oxide of manganese, and heating the mixture in a flask over a spirit-lamp. It is quickly given off, but cannot of course be seen; but by introducing a lighted candle, or a bit of phosphorus on a wire, the brilliant combustion will at once prove the presence of the gas. Oxygen is one-ninth part heavier than common air.

Nitrogen, like its colleague, is a gas without color, taste, or smell, and may also be made to assume the liquid form. It is quickly obtained by burning a small piece of phosphorus over water and inverting a gla s bell-jar over it, immersing the lower edge in the

water. The burning of the phosphorus will simply consume the oxygen and leave the hydrogen. It is one thirty-sixth part lighter than common air, and will not support combustion or animal life; a lighted candle placed in it is immediately extinguished.

The third component of our air is carbonic acid. It is a gas, void of color, but possesses a slight odor and is perceptibly sour and pungent to the taste. It is not a simple element, but a compound—carbon united with oxygen. Burning substances are instantly extinguished and animals cease to breathe when introduced into it. It is one-half heavier than common air, and is frequently found in the bottom of wells and mines, where it becomes confined and cannot be diffused, and often suffocates workmen who descend into it. The effervescent qualities of soda-water, fermented wines, and mineral waters are due to this gas. It is a varying constituent of the air owing to localities, character of vegetation, animal respiration, combustion, etc. It is greater at a distance from the earth than at the lower ranges, occasioned by plant respiration, if it may be so called. It may usually be stated to be one gallon in 2,500.

Carbonic acid may be easily prepared by pouring dilute muriatic acid upon chalk or limestone; the gas rises in the vessel through the liquid, but remains at the bottom, owing to its weight. As it collects it gradually ascends, and finally pours over the edge of the vessel as water would do. Its rise may be shown by introducing two lighted tapers, one above the other; the lower one will be extinguished first, and in a few moments the upper.

The fourth constituent of the air, watery vapor, is the steam or vapor of water which comes from the evaporation of lakes and streams, and from the surface of the earth.

In reconsidering one point in relation to all these gases, namely, weight, we are surprised to see at first how we are to have any atmosphere, for we have in nitrogen a very light gas $\frac{1}{36}$ part lighter than common air; in oxygen a gas $\frac{1}{9}$ part heavier; and in carbonic acid a very heavy gas $\frac{1}{2}$ heavier than the atmosphere. Why then have we any life sustaining atmosphere at all? Why is it that they do not maintain a just equilibrium, one above another, the deadly carbonic acid at the bottom preventing all animal or vegetable life? Here comes in one of the most beautiful and beneficent laws of nature, known in science as "the law of gase-

ous diffusion." This is a property that all gases have of intermingling one with another, as wine and water will intermingle. Many interesting experiments could be given illustrating this law, and showing how rapidly this diffusion takes place; so accurately is this known that chemists have learned to compute it with mathematical exactness. It is a law that is continually performing an important work in the atmosphere around us; accumulations of gases which are unfitted for the support of life, are by this means silently and effectually dispersed, and thus the composition of the aerial ocean which surrounds us is uniformly maintained. Independent of this we have winds and aerial currents which tend to blend and mix together the various gases of which the air consists.

Of the purposes served by these several constituents of the air, we will glance one moment. Oxygen is as necessary to the animal economy as any portion of its food, and it can only obtain it from the air; every breath that is drawn supplies a portion, and a like supply is necessary every moment. It is also necessary for combustion; without it fuel would not burn, and we could have neither light nor heat. If it was pure it would exhaust the body too soon, and life would be of brief duration, and combustion could not be controlled; but it is admirably adapted to the existing order of life, by being properly diluted with nitrogen; this not being poisonous as carbonic acid is, counterbalances the too active oxygen; it weakens and prolongs its action, and assuages its fiery influence.

But what of the deadly carbonic acid gas? It is as necessary to vegetable life as oxygen is to animal life. Every green leaf of the field and forest absorbs it throughout the day, breathing out in its stead oxygen, the reverse of animal respiration and were it not present in our air, the earth would be deprived of plant life, and consequently all animal life, for the animal is dependent upon the vegetable. The small amount of this gas present in ordinary air will allow of animals breathing it with impunity, but when increased beyond a certain amount, as we shall in time show, respiration becomes impossible; even though the amount of oxygen could be increased, the poison of carbonic acid would cause death should it rise above a certain point.

So also the watery vapor performs an important function. It is

very variable as to quantity, seldom more than $\frac{1}{60}$th, or less than $\frac{1}{200}$th of the bulk of the air. Water constitutes nearly $\frac{3}{4}$ of the weight of the plant, and from the surface of its leaves it is continually rising during the day. If the air was absolutely dry, it would cause this evaporation to take place more rapidly than the roots could supply it, and the whole plant would droop, wither, and die. The animal organization is equally dependent upon water, as it contains only about 40 lbs. of dry matter to 100 of water. From the skin and lungs water is continually evaporating. As in the case of the plant, were the air perfectly dry, the skin would parch and shrivel, the thirst would become intense, the air would absorb the moisture as it was breathed out of the body, the animal would soon breathe away the fluids that filled out its tissues, and become a ghastly mummy. Travelers tell us of the great fatality of the simoons and other hot winds of the desert which approach this condition of dryness. Again, without this moisture in the air the heat of the earth would radiate into space and be lost. We see also "that when the summer's sun has sunk beneath the horizon, and coolness revisits the scorched plant and soil, the grateful dew descends along with it, and moistens alike the green leaf and thirsty land—the invisible moisture of the air thickens into hazy mists, and settles in tiny pearls on every cool thing. How thankful for this nightly dew has nature everywhere and always appeared, and how have poets in every age sung of its beauty and beneficence." From the same atmospheric store of watery vapor come the refreshing rains, so we see that minute as it is in its division of particles, in the aggregate it is immense.

We speak of the air as being pure, but it is scarcely ever perfectly so. Combustion, putrefaction, exhalations from marshes, the fumes belched out of volcanoes, the accumulations of nitric acid resulting from the discharge of lightning; and in numerous other ways, it is being constantly contaminated, and were it not for the rains which constantly wash it and purify it, it would soon become unfitted for animal life.

We have thus spoken in as concise a manner as possible of the chemical qualities of the air; let us now look briefly at the physiology of its action upon the animal economy, as another prefatory step to our subject. We are all of us reasonably familiar with the anatomy of the lungs, the great organs of respiration. With the

large bronchial tube or wind-pipe; with its divisions and sub-divisions, which terminate in minute branches, which are surrounded by air-cells. In the mammalia it is estimated that there are about 20,000 air cells clustered around each terminal branch, and that the total number in the human species is not far from six hundred millions, presenting a surface of about 160 square yards. Now consider that the walls of these cells are closely packed with fine capillary vessels, which are terminations of arterial sub-divisions, and we can see how the blood of the system can be exposed to the air, for all the blood of the body must pass through the lungs in very short periods, varying in our different animals according to the frequency of the heart's action. The number and minuteness of the capillaries, and the vast expanse of lung surface accomplishes its aeration.

By respiration we see the following objects. It establishes the circulation of the blood at the commencement of life, the functional activity of all muscular and nervous tissues depend upon their oxydation, and this can only be by the introduction of air; the maintenance of heat is mostly due to the oxydation of disintegrated material of the body that is passing to waste, and of other combustibles, such as fat and sugar. All organic material at its death gives rise to two products under the action of the air, carbonic acid gas, and water. The condition of life being such as not to allow of the accumulation of this gas in the system, means for its removal have been established; the introduction of oxygen, and the removal of carbonic acid are accomplished by the same mechanism.

You may naturally ask the question, how does the actual oxygen of the air get into the blood, for it is confined in small capillaries; the wall of the vessel is between the blood and the air? It is explained partly by the law of the diffusion of gases, and partly by another law of capillary attraction, or, as it is called, endosmosis, and exosmosis, which will explain how gases and fluids can pass through membranes, liquid films, or porous structures. The whole thickness of a capillary vessel is only about $\frac{1}{3000}$ of an inch; therefore its walls must be extremely thin and present but very little obstruction to the passage of a gas.

When the oxygen is taken into the blood in the lungs, what then becomes of it? To answer this question we must bring the

microscope to our aid. By examining blood with this instrument we find floating in its plasma, or fluid portion, a vast multitude of blood cells, or globules; they are round, of a flattened shape like a coin, and all biconcave. In diameter they vary from $\frac{1}{2800}$ of an inch to $\frac{1}{4000}$, and all about $\frac{1}{1240}$ of an inch in thickness; their sacks or walls are elastic, which allows them to become elongated, thus enabling them to pass through the difficult passages of the minute capillaries; they can also become biconcave, or even globular. We find them arranged one upon another, in a more or less regular manner, and a few scattered about, presenting very much the appearance of a roll of coin when carelessly dropped upon the table, some still in position and a few scattered about. There are other cells in the blood, but our purpose is not with them; neither is it pertinent to our question to inquire into the composition or origin of these interesting bodies. I will call attention to them only because of their office, which is in the direct line of our inquiry, for they are the carriers of oxygen, absorbing it instantly in the lungs, changing the color at once from blue to red, and by its circulation carrying it to every portion of the body, where it is consumed in the production of heat.

Thus we see how the air that surrounds our world, colorless, tasteless, and almost unappreciable to the senses of man, becomes at once, when we study it, one of the most interesting and important questions of natural science. We have seen in the composition of the air how necessary are each of its components to the existence of both animal and vegetable life—how the injurious qualities of them all are controlled by opposite ones found in another. We have glanced at the structure of the organs of respiration and at the circulation of the blood, and have endeavored to trace how the fierce oxygen of the air is toned down and fitted for respiration, enters the blood and is carried to all parts of the body, and there silently and quickly consumed.

After this long preamble we come to the direct subject of this paper. We cannot take up a subject at once and discuss it, *per se*, without going back of it and looking at the conditions upon which it depends, as we have in this case, which has, I trust, enabled us to recognize the importance of a regular supply of pure air, which is more necessary for the maintenance of the lives of our domestic animals, or even man himself, than good food. We

read much of the requirements of good food and regular feeding; our agricultural journals are filled with practical and instructive articles upon it, lecturers descant upon the subject, chemists give us tables of food values, and we all know that a great deal of the thrift of our stock depends upon the quality and regularity of our fodder supply. But whoever thinks of the quality or supply of air that he allows his animals, or the effects of its deprivation? Alas! we seldom hear it spoken of, and the only thought of the farmer upon it seems to be to batten up the cracks and shut it out from his premises.

That there is a need of an agitation upon this subject is evident to any one who enters almost any stable in the country, especially in the morning; and well-constructed ones are worse, as a general thing, than those of a poorer class, for they are more hermetically sealed, the object being to make them warm. Little does the owner think that warmth at the expense of air is far more injurious than a cold air, which supplies a full amount of oxygen for combustion.

It has become the fashion of late in many sections to have the stalls for both horses and cattle arranged on one side of the barn and to enclose them by a partition in front, the lower part permanent, the upper to be opened or closed at will. This allows of an apartment of only about seven and a-half or eight feet high and twelve deep, and long enough to meet the space demanded by the stock kept. The plank floor is saturated with decomposing filth, which emits its sickening odors continually. These stables are generally over a manure cellar, where the whole accumulations of a season are slowly fermenting, filling the whole place with deleterious odors. Here the cattle are confined and compelled to breathe over and over again the imprisoned air till they have exhausted its oxygen and loaded it with carbonic acid; this combined with the odors from their excretions make it a place wholly unfitted for healthful habitation. Milk manufactured in a stable like this is contaminated before it is drawn from the animal, and rapidly receives further taint by absorbing it from the air before it is taken to the dairy rooms. If the evil ended here it would not be so bad, but this unwholesome milk is in many cases the only food of children, who are watched over by tender, loving parents, mourning over their feeble offspring, unknowing that they them-

selves are slowly administering a poison by the very means that they are using to restore them to health.

The rough and rude treatment to which the lungs of our animals are subjected, the vitiated air that they are compelled to breathe, and the artificial temperatures to which they are subjected, show clearly how little the value of a mild and fresh atmosphere is practically appreciated, while the ravages of consumption and the extended catalogue of evils that accompany diseases of the respiratory organs point out the vast amount of misery that might be obviated, and death that might be prevented, were the leading principles and requirements more generally understood. Nature has by a simple and efficacious process provided for the ventilation of the lungs, and it is for man, when he makes the free animal a prisoner and subservient to his wants, to use the reason with which he is blessed to imitate the beneficent provisions of nature and to secure for it, as indicated by science, the means to provide in every place which they inhabit a gentle current of that invisible atmosphere that was intended to be the source of life, but which he oftentimes makes a transmitter of disease and death.

But it is not for the oxygen of pure air alone that we ventilate our stables; there are other reasons that prompt us to it, and with very powerful appeals. The atmosphere is at foddering times filled with a fine, impalpable dust composed of the earth and grit of the fields, which is brought in with the feeding material at the time of harvesting, with the pollen of grass and flowers and minute portions of stalk and leaf, and also the spores and germs of moulds that in damp seasons our fodder is apt to be contaminated with, and which, when breathed into the lungs, act as foreign matter—as an irritant, and consequently produce congestion and inflammation.

Do not accuse me of drifting from my subject if I speak of another and very essential reason for ventilation, namely, the germ theory of disease. Without going minutely into the matter, it is enough for us to know that modern science has pointed out and has established the fact that the most fatal of our contagious diseases are due to the planting of low forms of life within the animal system; these forms are termed bacteria and are divided into different distinct groups. They are small microscopic bodies, having various forms, and exist in innumerable numbers in all

putrescent fluids, especially in blood and urine, and also in the blood of animals having certain diseases. They vary in size as well as in form, some requiring the highest powers of the microscope to define them. Sanitary science has made vast strides in the last two decades, largely due to the investigations and experiments in connection with these infinitesimal bodies. They have been propagated by placing them in a proper nidus, such as a slice of apple, water and milk, water and blood, or water and urine, and have been thus bred for several generations, and finally the animal system inoculated with them, producing the true form of the disease that they are charged with originating.

In the last few years it has been claimed that the various specific diseases are caused by different species of bacteria, and to some extent this has been demonstrated. This is instanced in the swine plague of which we have heard so much, and which has been so ably reported by Dr. J. H. Detmers of Chicago, who conducted his investigations under government auspices, for a full reading of which I will refer you to his report to the Commissioner of Agriculture in 1880. The result of some of his experiments showed "that an inoculation with bacilli and bacillus germs, cultivated in so innocent a fluid as milk, will produce the disease with just as much certainty as an inoculation with the pulmonial exudation from a diseased or dead hog." It appears also from the experiments of Dr. Detmers, and they have been fully confirmed by Dr. Law of the Cornell University, that the special contagion of swine plague may be communicated to other animals.

Why have I called your attention to this special subject? It is this: These minute bodies are capable of self-multiplication, and within a very limited space of time, and being so marvelously small and light, they are taken up by the slightest currents and mingled with the atmosphere. If the air is dry and pure they soon perish. In pure air charged with watery vapor, such as is given off by animal respiration, they live for a length of time undetermined; but in humid air, charged with putrid animal matter, they live, nourish themselves, and acquire the full vigor of their nature. It is not necessary to inoculate an animal with them, for when they exist in the air they will find their way into the fluids of the body, through abrasions of the skin or mucous surface, or by being drawn into the lungs themselves. All classes of animals may receive them;

even man is not exempt. A case illustrative of this is seen in a new disease which has recently appeared in England, termed actinomyces, evidently brought from the continent, where it has been known for only a short time. Mr. Fleming, the army veterinary inspector of England, has within the last month called public attention to it, and declares that it prevails extensively among cattle, and that he has found it in pigs, goats, a horse and a dog; while the German medical journals report some sixteen cases in the human subject, and declare it to have been received, undeniably in some of them, from the lower animals. It manifests itself by great enlargement, induration, and ulceration of the tongue; attacks the bones of the face and jaws with tumors both inside and outside of the throat, and is very destructive, especially to young stock. Mr. Fleming, by microscopic examinations and experiments in propagating it, clearly shows the affection to be due to a minute fungus which he declares obtains an entrance into the system as has been described. I simply introduce these facts here to show that impure air can be loaded with disease germs, that they can be communicated from one animal to another, and that if the farmer himself isn't mighty careful, he may receive, at some time, an awakener far more powerful than this paper.

In making plans to ventilate a building the first question that arises is: How much air shall be admitted and allowed to escape? Then appears another—how to give it admittance and egress? To answer these questions we must first consider the use to which the building is to be put, its location, whether on high or low ground, whether surrounded by hedge, forest, or hill, or exposed to the full sweep of the winds. The barn for the storage of fodder does not require as much fresh air as the stable, neither must we compare the stable or piggery with the dairy house and root cellars, therefore we cannot give a rule to be followed, in all cases, of so many cubic feet of air to a certain size of building, but we can have a standard to go by, and in all cases it is the requirements of a man of the average weight of 140 lbs.

Twenty thousand one hundred and sixteen times in every twenty-four hours does the human chest expand and contract in the process of respiration; forty-three per cent, by measure, of this expired air is carbonic acid, and when taken into the lungs again is a sure poison. The small proportion existing naturally in the air is in-

nocuous; it can be increased somewhat without injury, but it is decidedly prejudicial to breathe for a long time air containing one measure in 100 of carbonic acid; it is considered desirable that the measure should never exceed one in 500. We may assume that twenty cubic feet of air pass through the lungs every hour, to reduce the poison to one per cent, at which point it is barely respirable; it requires to mingle with as much fresh air as will make a mixture of 100 cubic feet, and, to make the dilution entirely safe, it must be carried five times as far. To state it simply, the respiration of one individual requires 500 cubic feet of fresh air per hour. I have placed this estimate quite low; some authorities place it as high as 1,600 cubic feet per hour, but I select the lower, believing it to be nearer the truth, and not desiring to astonish you with large figures, and perhaps receive from you the name of being a sensational speaker. I make no estimate of the contaminating influence of other sources of vitiated air, as the exhalations from the skin, the excretions, etc.

In making an estimate for horses and cattle, it is customary to allow three times as much air for each individual as in the case of man, but, if we multiply by five, we shall gain far better results. A pig, if he is kept in a clean place, will require about the same quantity as a man; as he is usually kept, however, I am surprised that the race did not become extinct long years ago; it speaks well for his vitality. Works on architecture will provide you with any number of rules for finding the amount of fresh air required in the various buildings of the farm, such as multiplying various dimensions together, and dividing, by certain imaginary figures, but in actual use they are of no account, and I leave them without consideration.

Before touching upon the mechanical principles of ventilation, it is perhaps necessary to call attention to the fact that the virulence of poisoned air does not so much depend upon any known condition of the gases as upon the personal condition of the victim, such as age, state of health, etc. A vitiated air may be breathed with impunity in hours of activity, that would produce serious ailments if breathed when the system is in the non-resistant condition of sleep, or even rest. As an illustration of this fact we may mention that serious troubles have time and again been traced to the sewers of Paris, but that zymotic diseases are comparatively rare among the 600 men who find employment within them.

There is another point having a strong bearing upon the health of animals breathing a contaminated atmosphere: it is the disturbed electrical conditions, a subject not yet fully developed, but sufficiently so to show that air fit for respiration is positively electric, and impure air, unfitted for breathing, is negatively electric. In this condition there can be no ozone or active oxygen, a higher form of oxygen, as the diamond is a higher form of carbon than we find in common coal.

Ventilation consists of two processes, the removal of foul air and the introduction of fresh. This art, if I might so term it, is still in a rude and imperfect state, notwithstanding all the recent improvements that have been made. We hear it frequently spoken of now in the sanitary considerations of our houses; it is fashionable now to talk sanitary science and to be healthy, a step in the right direction—and in ventilating them we are greatly aided by our arrangements for artificial heating, but for our farm building we have no auxiliaries, but must consider it alone.

As we have stated, air, when expelled from the lungs is largely composed of heavy carbonic acid gas; it might be thought that its heavy specific gravity would cause it to descend, but it must be remembered that it is brought to the same temperature as the body and acquires an upward tendency of very considerable force, as may be illustrated by breathing in the open air in frosty weather; the mixture of vitiated air is much lighter than common air, even at the same temperature, a very beneficent law for our comfort and health, for it quickly rises above the zone of our respiration, so that it cannot be breathed again. If, then, we take advantage of this simple law, and fashion suitable means of egress in the upper portion of our apartments, where it naturally arises, we free ourselves from its pernicious influence. Its place must be supplied with fresh, through suitable apertures, made in proper positions; it will not come in through the opening in the roof or ceiling, for that is already occupied by a strong current of outgoing air. The pure air is heavy and seeks for entrance below the space occupied by the impure. "Nature abhors a vacuum;" as the warm and contaminated air arises, a partial one is formed, the external pressure of fifteen lbs. to the square inch drives the fresh air in to fill it. If, then, we make suitable apertures near the floor, and in the ceiling, our aim is accomplished. This is the whole art of ventila-

tion in the abstract or rough; in detail it is very considerably more. A good illustration of these currents of air can be made by holding a lighted candle at the top of a door partially opened from a warm room, the flame of the candle will be seen to draw outward, following the outgoing current of warm air; by placing the candle at the bottom of the door the reverse takes place, the flame is drawn into the room by the inrushing cold and fresh air.

It is not the purpose of this paper to describe the various mechanical contrivances for creating currents of air in close buildings, and thereby ventilating them, for their name is legion, and it would only weary you in the recitation, should you wish to pursue that branch of inquiry. I must refer you to works of architecture and to builders' journals. The aim of this paper is *to call attention to the matter* in the most forcible way that I can, in the limited space of time that has been assigned me, which will only admit of general rules.

The admission of fresh air is a more difficult matter than the removal of the vitiated. In our dwellings we can warm it before admitting it to our apartments, or soon afterwards, but the nature of our farm-buildings precludes the use of fire; our object is to admit it in abundance, but not in such a manner as to create a draft, or to chill the animals. This is best accomplished by bringing the air from the exterior of the building, at a level with the floor, in a board box at least ten inches square at the ends, and running the length of the stable, or a suitable distance into it. This box or trough should have small openings at regular distances, which will divide the current of air, as a rose at the end of a hose-pipe will divide the stream of water that flows through it; or there could be several of these boxes constructed on a smaller scale and placed in suitable positions. If the barn cellar is not used for the storage of manure, and is kept free from all articles that would corrupt the air, the supply could be drawn from that locality, for it is a few degrees warmer than the outside air. But the air of cellars is generally as much defiled as that of the stables, and as unfit for respiration; in fact many cellars require ventilation more than the structures that are built over them.

It is not well to ventilate one apartment into another, for nothing is gained but a little additional space. The tainted air of a stable turned into a hay-loft will contaminate the fodder kept

therein; it becomes saturated with the deleterious particles thrown off from the animals' bodies and their excrement, which soon putrifies and renders the whole unfit for food. This is one of the principal objections against the ordinary cattle arrangements in our common barns; there is no separation of the stock from the hay, they are all in the same apartment, every fresh surface of hay exposed absorbing its share of the poison.

All stock should be kept in an apartment by itself, which should be ventilated by flues which connect with the external air through the roof or sides of the building; these should have shutters or regulators to close them when necessary; the openings for the ingress of fresh air should be protected in like manner.

Ventilation by lowering windows from the top, or by having one pane of glass hinged so as to open inwards, are excellent ways provided they are situated in the right place, but they cannot be well arranged so as to admit fresh air without at the same time establishing drafts; therefore this means is a little objectionable for stables. In some localities, double sash with openings in each will answer the purpose well, as the air is partially warmed before admittance. The movable squares must not of course be opposite to each other.

I speak of the ventilation of farm-buildings; allow me to include in the list the ventilation of the farmer's own dwelling. If my remarks have been correct regarding ventilation for stock, they surely will apply to the family circle, for nowhere do we see the evils arising from unventilated apartments more than in the human family. I was about to say in the farmer's family; and if you will not consider it too personal, I will so express it. This comes mainly from the nature of the farmer's calling. He raises vegetables for his family use and for the market, and protects them through the winter in his house cellar; here he has cabbages, potatoes, beets, turnips, and the savory onion, a few decaying pumpkins left over from thanksgiving, a beef and pork-barrel with the last season's strong and tainted brine, trying to excel in pungency the fumes from the casks of cider and vinegar, while the long-forgotten codfish that hangs at the head of the cellar stairs gives a body to it all that can never be obliterated from the memory. Gentlemen, do not think that I overdraw the matter; I speak from a professional experience not soon to be forgotten. I know that when I invade the sanctity of home that I am treading

on dangerous ground, and may arouse feelings of resentment, therefore I hasten to assure you that it is not your homes that I speak of, but those of your neighbors, who live down the road a-ways or over the hill. These odors from their cellars will help to explain why they make such wretchedly poor butter—as you know they do—for they permeate not only their living-rooms but the dairy-rooms, and are absorbed by the milk before it is churned, and by the butter after it is made.

If you should ask me how to ventilate your cellars, I should say, have none at all to ventilate. A properly-constructed building above ground, with partition for dead air, and secured from the cold wind by close hedges, would be far less costly, more convenient in using, and above all, more healthful. But you say that you have cellars already. Then put as many windows in them as you can, all around, and let the free winds have full play.

It is not necessary for me to dwell upon the need of a free ventilation for the dairy-room; every practical farmer knows how quickly milk, cream, and butter receive the odors from the air. As has been stated, milk will receive it before it is drawn from the animal. Butter and cheese generally sell according to its quality, its *rank*, if we might so express it. Think what a deficit it makes in the yearly income of a dairy, if the price is reduced even one-half cent per pound by reason of bad condition. But I notice that the receiving merchant seldom divides a cent for any reason, but drops a whole one.

In order to have a wholesome, pure air for our buildings, we must look somewhat to their surroundings. How often we find in the neighborhood open cess-pools, stagnant ponds, filled with drainage from barn-yards or manure-heaps, decaying wood and rubbish, and not unfrequently dead animals thrown carelessly on the compost pile, there to add their putrid odors to the already tainted air. Better trust your stock to the kindly protection of a rail-fence than to introduce such an atmosphere into their apartment.

One other suggestion. We farmers have had the reputation in the past of being rather close and self-denying; for fear that any of you may be inclined to shut out oxygen for fear of using up the supply, I will state that nature has an abundance of it; it constitutes a large part of the mass of the earth, and it has been cal-

culated that at the present rate of consumption, there is a stock on hand to last 100,000,000 years.

My task is done; but I feel as though I had barely touched upon a few of its points. There is much to be learned yet, both by the practical and scientific man. The inventor will here find room for his genius, and the chemist a comparatively unexplored field in the changes that take place in fermenting matter and animal excretions. The physician will receive reward for his research and reasonings, and the microscopist ample opportunity to test his wonder-revealing lenses. By it all the animal will be benefited in its health, and the farmer in his pocket, besides the satisfaction of having well-developed stock, beautiful to the eye, sleek and glossy to the feel, carrying themselves with vigor and elasticity, his cows yielding a healthy, life-sustaining milk, and his oxen and horses performing their assigned tasks with spirit and animation. There should also be a deeper feeling than this,—that we have not ill-treated a dumb and dependent animal.

Mr. GOODWIN. I call the doctor's attention to the injurious effects of a superabundance of shade trees around a dwelling, whether that has come within the sphere of his observation?

Dr. BOWEN. Yes, sir, I have thought of it, but I could not speak of everything in this paper. It is a very injurious thing to have shade trees too near a dwelling. They have a tendency to chill and dampen the air. I think the aim should be to induce a dry atmosphere, and not one too damp or too moist.

Prof. BREWER. Don't you think that ill ventilation is more excusable in fattening animals than it is in keeping animals for work. That is, if you are fattening animals, wont they stand, for the time being, rather poorer air than working animals? We are going to kill them off, any way, in a little while. They will not burn out quite as much fat in keeping themselves warm. I know that very often the surroundings of fattening animals are very unpleasant, and the supply of air is not very great. I believe that one of the most eminent breeders in the country considers that animals with very small lungs fatten best. What do you think of that?

Dr. Bowen. I think very likely, just as a man with a head about as big as your fist does not think quite as much as a man with a good development.

Mr. Goodwin. In my experience, our best feeders have their fattening animals exposed in the open air part of the day, outside of the buildings.

Dr. Bowen. I believe the best beef that is brought to the Chicago market comes from animals that are never housed at all. They are kept in the open air through the whole winter. I think the gentleman who furnishes that beef has the reputation of having the best fat stock in the country.

Mr. Augur. Dr. Bowen has alluded to the open vinegar barrel. I would like to ask him if an open vinegar barrel is deleterious to the atmosphere?

Dr. Bowen. Perhaps not in itself, but it adds to the pungency of the odors. I only brought it in with the others. I think a little acetic acid is not objectionable.

Col. Warner. I would like to inquire of the doctor what he would advise as the best method of ventilating our stables? He described in detail the way and manner of bringing pure air into the stables. I did not catch the way in which he would get rid of the carbonic-acid gas and the impure air in a stable.

Dr. Bowen. The carbonic acid gas will rise to the top. Let this box represent your stable, and the bottom part the apartment where your cattle are kept. The upper part will be filled with vitiated atmosphere, and the lower part with a more healthy air. If you simply make an aperture in the roof, and connect it by a flue with the lower part of the stable, the bad air will find an entrance to it; it will rush up. If you hold a lighted candle there, you will see a flaring flame rush up, showing that there is a strong current. Or if you throw a little chaff into the flue, or a piece of paper, it will be drawn up at once, showing the same. If that continued, there must be a vacuum in this building, of course, supposing it were hermetically sealed. Under the immense pressure—fifteen pounds to the square inch—outside of the build-

ing, all the cracks and crevices are filled by in-rushing cold air. We simply take advantage of that, and introduce that air by apertures at the bottom. Those can be made directly through, but that creates a draft; it comes in in a too solid body. I would suggest a box, two or three feet wide and deep at the ends, running the length of your stable, with numerous perforations, which allow the air to be divided, as I said, the same as the current of water going through a hose pipe is divided by the hose nozzle that is oftentimes put on the end. Sometimes the air is introduced by an aperture at the top through the building, with a funnel coming down to the bottom; the idea being to warm that column of air a little before it is introduced into the building by the warm air in the room. In that case, the opening should be at the bottom.

Col. WARNER. I should like to ask the doctor another question in connection with that. He says the carbonic acid gas rises. He has previously told us it was heavier than the atmosphere. How, then, can it rise?

Dr. BOWEN. Because it is warmed by passing through the lungs of the animals.

Col. WARNER. Yes, but after it is thrown out from the lungs it becomes immediately of the same temperature as the air with which it intermingles.

Dr. BOWEN. It rises first, before it has a chance to intermingle.

Col. WARNER. The cattle are lying down; they breathe right down by the floor. The carbonic acid gas immediately, or within a short time, becomes of the same temperature as the surrounding atmosphere. I think most of our scientific men now say we should ventilate our houses from the floor. Heretofore it has been done from the ceiling, because, as the doctor explains, the air being lighter and warmer up there, it will of course escape, and there will always be a current there, no matter whether there is any impure air in the room or not. One of the most celebrated heating companies in America to-day recommend putting our apertures for getting rid of the vitiated air in the mould-board, so to speak, around

our houses, and they have very extensive diagrams explaining it all, with scientific certificates backing up the position that that is the proper place to get rid of the bad air in our dwellings, not at the top, as heretofore. And in recently discussing this matter with an intelligent engineer and architect, he said, "we ventilate entirely from the bottom of rooms, and one of the best ways in the world to ventilate a dwelling is by a low fire-place. Our old fathers understood it, and that is why they were all so healthy—they all had perfect ventilation in their houses. And that, I think, is why people are putting in fireplaces, as I do into every building I put up. I think the natural and true way to ventilate our houses is to let the hot air come in from the furnace, or steam-pipes, or stove, and get rid of the impure air down at the bottom." That seems to be the theory, and of course we have to follow the scientists. They are the men who ought to know, and they tell us that by ventilating our rooms at the bottom, we get rid of the vitiated air and of the carbonic acid gas that is lying down there.

Dr. Bowen. I know that is the theory. There have been all kinds of theories brought forth in some quarters, some of which prove more efficacious than others. You have got to consider the shape of your room, the use to which it is put, and the surroundings of the building, before you determine to adopt any system of ventilation. That method does not answer as well in many cases as more simple means of ventilation. You can ventilate in that way; it is successfully done; and you will find, as has been said, that there are a great many diagrams given by builders, very nicely illustrated with beautiful arrows showing how the currents of air go through a room, but if we attempt to follow them out, we find that it is very much like the labyrinth that we used to work out in childhood, and we generally reach zenith about as we did when we got into the center of that. It is hard work to do it. I spoke of the most successful means by which practical farmers, such as I conceive we are here, can ventilate our stables, as we have them. That is the reason I have brought

that into my paper in that way. I think the ordinary farmer would not care to study up the subject of ventilation sufficiently to put in such an apparatus as that would require. He can ventilate his stable by opening suitable apertures in the roof, and bringing the air in at the bottom.

Col. Warner. There is one point I do not understand. The carbonic acid gas that is thrown off from the lungs, the doctor says, is heated and rises. Now, supposing the carbonic acid gas is heavier than air, why does it fall?

Prof. Brewer. Let me answer that question. There has never been an analysis made anywhere—and there have been a great many thousands made by competent authorities, of air in crowded rooms, in theatres, in lecture-rooms, and everywhere else—that showed that the amount of carbonic acid gas was greater at the floor than at the top of the room. I have looked up this matter with a great deal of care, and know what I am talking about. That carbonic acid gas was generated at a temperature of 100 degrees or more; we will say 99 to be exact; that is the temperature of the human body. Now, when carbonic acid gas is mixed with air, as it is in the breath, it never separates; it does not sink to the bottom; it is mixed with the air. There is a small amount of carbonic acid gas, a large amount of air, and its temperature is a hundred degrees, and it rises to the top. It has been examined from crowded rooms, from churches, from theatres, from all sorts of halls, and that is where it rises—to the ceiling.

Now, we may get two things that are involved in this ventilation question badly mixed. "Architects mix them"; thousands of persons mix them. Whether you should ventilate from the top or the bottom, turns wholly and entirely upon how you are going to heat your room. If you heat your room with hot air, and bring it in warmer than the room, the hot air rises. Now if you open a hole in or near the ceiling, the hot air goes out immediately, and you cannot heat the room. When you are talking about ventilating a house that is heated and a stable that is not heated, you are talking about two entirely different things. If you are going to heat

a room with hot air from outside the room, and bring it in through a register, the hot air is bound to rise from that register to the ceiling, and if you open a hole near the ceiling, the hot air goes out, and you do not get the benefit of your fire. If you want to draw the air out from the bottom of a room, you have got to take it out by a flue at the top of your house. When you have a room heated by a stove, or by an open fire, then you can open a hole at the top of the room, because you have got another source of heat there; you are using radiated heat; and such a room as that gets its air from a great many sources; from cracks in the doors, from cracks in the floor, from cracks in the windows; and it goes out through the fire-place or up the stove-pipe.

Now, if you have a stable to ventilate, if you run out your flue at the top, the air is bound to go out at the top, if there is any place for it to get in at the bottom. Run two flues to the top, and the air will come down in one and go up in the other. Any one can try that experiment. Take an ordinary lamp chimney; cut off a piece of candle half an inch long, light it, and set your lamp-chimney over it; if there is no air comes in at the bottom, the candle will go out. Now, if you put a partition in that chimney, half-way down, the instant that is done the light will come up, because the air will go down on one side and up on the other. Ventilation ought always to be by double shafts, one up and the other down; but inasmuch as you do not heat your stables by furnaces, you do not need to have ventilation from the bottom.

Mr. Webb. I built a barn a few years ago, partially under ground, so that it is open on two sides, and partially open on one side. The barn stands north and south. I had the roof project over about eighteen inches, and put in ventilators on two sides, extending from the roof down to the stable, four feet wide and eighteen inches deep, boarded up so as not to be an obstruction in handling the hay. I put in two on each side, next the partition, with openings about a foot deep under the roof, with sliding doors at the bottom. When the wind blows from the west or northwest there is a very strong

current of air coming down the flues on that side, which makes the stable very cold; so much so, that the running water which I have in the stable will freeze. My stable-man, when the wind blows from the west or northwest, closes the ventilators on that side and opens them on the other, and in that way we can have ventilation from either side, according to the wind. When the atmosphere is quiet, we can take a feather and go to one side, and it will fall or float; if we go to the other side, it will rise to the chimney. That is just as Prof. Brewer has said. Ventilate from the top, and the air will come down one side or the other. There are sixty head of animals in my stable, and you will find very little difference in the atmosphere. The stable is comfortable; my men will go in and milk in the morning at this season of the year with their coats off; water will not freeze there, and there is no odor or taint in the stable at all.

My barn is forty by seventy. At the extreme north end I have a large ventilator, five by three, running out at the top, where it does not interfere with the hay or anything. That is constantly open. I have another stable, thirty by forty, which I built entirely without ventilation, and kept it pretty cold. I had consumption in that stable, from the vitiated air, I think. I then cut out spaces over the windows. I had the windows at first so that I could let them fall, to give that amount of ventilation, and I have three sliding doors on each side of the forty-foot stable, and as the wind changes I open or close them, on either side. There are three of those ventilators, a foot square, on each side of my stable, and they are opened on one side or the other, as the wind may blow. Water does not freeze in my stables, and they are as nearly perfectly ventilated, I think, as they can be, and there is no odor and no trouble.

Dr. Riggs. Some twenty-five or thirty years ago, I had occasion to repair a barn, to get it into condition for containing a stock of horses and Jersey cattle. The barn not being large enough for my stock, I built an L upon the south side, with a manure stable underneath, and cattle above. I had two

large ventilators in the top, which were so constructed that the passage of the wind drew up the air out of the ventilators. But what I wish to describe more particularly is the construction of the stable where my cows were. The stable was eighteen feet wide, and only one tier of cows kept in it. In the rear of the cattle was a bin running about forty-five feet, and four or five feet high, and that bin contained yellow earth, put in in the heat of summer, when it was very hot, and at odd times, and it was for the purpose of absorbing the manure, and to generally deodorize the whole stable. Underneath was a manure cellar, ten feet deep, occupying the whole space, containing from sixteen to twenty pigs—fattening shoats. My cattle were all bedded down in stalls and fed from the barn-floor. Now, no stable is perfect without deodorizing. I care not how much ventilation you have, the manure will be sure to taint the milk unless you use some deodorizer. I had several ventilators, some from the top of the stable, and some running from the bottom, and even running down into the manure cellar, and carried up through the roof, with an apparatus on top, made of boards, so arranged that whichever way the wind blew it would strike that and draw out the air from beneath. After the stables were cleaned in the morning, the bedding was thrown aside; that which was dry was retained, that which was wet was thrown into the cellar below, and then the workman took his shovel, turned round and worked it into this dry earth—just as dry as it was in the summer—no moisture in it of any consequence—and scattered from half an inch to an inch under the cattle and in the trench back of them. The result was, visitors who came to see my cattle said, "Doctor, how do you keep all bad odors out? We do not smell anything here. A man could eat his dinner here." "Yes," I said; "don't you see this deodorizing material, common earth, which is the best deodorizer you can get, only have it dry?" No stable is complete without it, gentlemen. It costs you a little labor in the summer, but it will much more than pay for that labor in the beneficial effect which it will produce. You do not want any great air cur-

rents driving into your barn in winter, any more than you do into your dwellings. On such a day as to-day the air will rush into every aperture, and you will get air enough. Any barn, as a general thing, in the winter time, will be cold enough, and even if you ventilate (I must differ from some of these gentlemen) I think there is a vitiated atmosphere at the bottom.

I had a hennery four feet under ground and five feet above. It was built of brick, and made to be warm. I wanted to get my eggs in the winter, when I could get fifty or sixty cents a dozen for them, and I did do it. My pullets were made to lay four months after they were hatched. I found that the bad air in this hennery could not get out. That was a point I did not think of when I constructed it. So I made a flue reaching up to the gable of the roof and running down to within four or five inches of the bottom of the hennery. I had no difficulty after that in making that hennery just as nice in its atmosphere as your barn or your house. The draught was altogether up. There was air enough came in, although the windows were as tight as they could be. The result was, I had a pure atmosphere there, and my chickens were not diseased; they were healthy and happy, crowing and cackling, and, what was most important to me, laying nice eggs.

Mr. Webb. I want to say four words only. Ventilate by the introduction of pure air and the expulsion of the bad, and deodorize with plaster of Paris.

Dr. Riggs. The planks in your stalls will get so saturated with urine that you cannot clean them in any other way. You have got to cover them with earth, the best deodorizer in the world.

Mr. Webb. I do, doctor.

Dr. Riggs. Well, all right. You have heard me preach this before at our meetings, ten or fifteen years ago.

Adjourned to afternoon.

## AFTERNOON SESSION.

The meeting was called to order at two o'clock, by Mr. Day.

The CHAIRMAN. I have been asked by several gentlemen, on looking over this programme with them, how a Professor in the Scientific School at New Haven could know anything about "the trotting horse." The gentleman is here to answer for himself, and when he gets through, you will know what he knows about the trotting horse.

## THE AMERICAN TROTTING-HORSE; WHY HE IS AND WHAT HE IS.

BY PROFESSOR WM. H. BREWER, OF YALE COLLEGE.

The American trotting-horse is a very modern production. Our ancestors did not have the trotter, and what is more, did not want him. Why they did not want him and consequently did not have him, how it has come about that we do want him and consequently have produced him, why he has been made, how he has been made, and what he is made of, is my subject.

As my audience is a mixed one, and not one of professional breeders, I will say on the start that I do not purpose to discuss the special blood or pedigree of any particular trotter or strain of trotters; that is the subject of an abundant literature, and to be of any use needs closer study than is possible in a popular lecture. My aim is more especially to portray the influences which have led to our breeding the trotter and the rich results already attained. If I seem to ramble from the subject, remember that trotters themselves sometimes disappoint the spectators, and with lecturers as with trotters, they may start well, but break and fall behind on the course and win no record.

The horse has been an essential factor in our civilization. What kind of a civilization we might have attained without horses I cannot say, but this much is certain, it would not and could not have been anything like that we now have. Moreover, the higher the enlightenment of a people, the greater the variety of uses to which horses are applied, and the American trotting-horse is a special product of the highest civilization the world has yet seen.

The horse first appears in history in Egypt. Lenormant dates his introduction into that country at the time of the "Shepherd kings," about 2,200 B. C., say about 4,100 years ago. The ass and other domestic animals are figured on the monuments much earlier. Among the Assyrians he also appears after the other domestic animals, and it was some 500 years after Egyptian mention, and long after the ox, ass, sheep, and camel are spoken of that the first allusion to him occurs in the Old Testament scriptures, and the Hebrews probably did not use horses until Solomon's time. In Psalms the horse commonly appears only on the side of their enemies, and in a battle in the East, towards the Euphrates, where David captured the cavalry, he destroyed most of the horses, apparently because he could make no use of them (2 Saml. viii, 4). It was some three hundred years after Solomon's reign before the Greeks had cavalry; so historians tell us.

There are in existence a very large number of ancient representations of horses in statues, bas-reliefs, coins, engraved gems, and other works of art, so that we probably know pretty well what kind of an animal the horse of antiquity was. He was a small, strong, tough, muscular beast, but he was not a swift one in the modern sense. In a general way the relative fleetness and strength of different breeds of horses is indicated by their form, particularly by the angles which the bones of the legs form with those of the body. In those breeds noted for their fleetness the humerus forms a more acute angle with the shoulder-blade, and the femur with the pelvis and tibia than in those breeds more specially noted for their strength. This gives the latter heavier necks and shoulders, and more rounded buttocks than the swifter breeds have. This was the character of the horses of antiquity; this was the horse of ancient Greek art, and remains the horse of Art even to this day.

I have examined all the ancient representations of horses within my reach for many years, and they abundantly show that however fond the ancients may have been of racing, their horses would have stood no chance with the race-horses of to-day. There is a difference between these ancient horses and those of the modern course almost as great as the difference between an ancient Greek or Roman chariot and a modern trotting sulky. A large portion of the celebrated frieze of the Parthenon is in England (known better as the Elgin marbles), on which there are over two

hundred representations of horses. We have in the Art School of Yale College casts of the better portions of these bas-reliefs, and also other Greek representations of this animal. There are figures of twenty-eight horses, all date earlier than 300 B. C., and some are doubtless by Phydias himself, and represent the best days of Grecian art. They all represent small, tough, "wiry" breeds, all are dish-faced like the modern Oriental breeds. and all except one are roached. This is also essentially the character of the horses represented by ancient Egyptian, Assyrian, and Phœnician art. The art is often very rude, but the breeds represented are essentially the same type.

Of more interest in this connection are the attitudes of these ancient animals. Of the more than 200 horses sculptured by Phidias on the famous frieze of the Parthenon, there is a great variety of attitudes, but not one is represented as trotting. Youatt, in speaking of these figures says (p. 211, Ed. 1831), "only four are represented trotting, and these are wrongly made in that both legs on the same side of the horse are raised at once." It seems to me much more probable that the old Greek sculptors were right; they studied their subjects faithfully and most probably intended to represent ambling (or as we say *pacing*) horses. The horses of ancient sculpture are almost universally in this attitude if not represented as rearing, galloping, or prancing. In the famous Cesnola collection in the Metropolitan Museum of Art in New York, the horses on the old sarcophagi, dating six or eight centuturies B. C., are all in pacing attitudes. In the Museum of Fine Arts in Boston, there are many Egyptian, Assyrian, Phœnician, Greek, and Roman representations of horses; none are trotting, but many are in ambling attitudes.

The same thing is shown on numerous coins and medallions to be found in collections. Modern artists have told us that this position which I have called the ambling attitude (the two legs of the same side moving together, or in the same relative position if at rest), was a *mannerism* of ancient art. In a sense this is doubtless true, because other animals are sometimes (not always) shown in the same attitude, but, it seems to me, that this very mannerism was founded on the fact that in those early times trotters were despised and ambling horses more or less used, and that the preferable animals were represented in art. When we remember that the ancients rode without stirrups, we need not wonder that they

despised a trotter and preferred a well-rounded, broad-backed, galloping or ambling animal.

The horse of Art, from the earliest Egyptian and Assyrian sculptures down to the present century, was not a swift horse, like either the modern runner or trotter. However much the individual animals differed, or even the breeds differ, the most prized animals as a whole were strong rather than swift, heavy for their height, with heavy necks, broad chests, and the well-rounded buttocks we are all familiar with in the horses of art all down the ages, and which most artists still like to put in pictures or statues, but which we see in use chiefly hauling drays or express wagons. In that most popular of horse pictures, found in so many houses in the land, representing "Sheridan's Ride," doubtless made by an admirer of Greek Art, we see the gallant General mounted on the broadest of cart horses, going at a rate that would wind him in two miles, and leave him drooping before he was the half of the "twenty miles away."

The horse is especially susceptible to the influence of surrounding conditions. When horses become wild and live as wild animals do, they develop naturally into native breeds, as instance the wild horses of South America, the mustangs of Mexico, the wild ponies of the Falkland Islands, and numerous other examples that might be cited. In domestication, surrounded by the various conditions which the artificial life imposes, and in obedience to the varied wants, uses, fashions, and sentiments of society, new breeds are moulded into shape until there is a vast number of breeds in existence differing from each other more widely than do the breeds of any other domestic species except dogs. It is not uncommon to see draft-horses ten and sometimes even twenty times as heavy as some Shetland ponies, and they differ in their endurance, temper, and instincts as much as they do in size and shape. Nearly every region has breeds or at least strains of its own which have originated there, the special characteristics of which are in part owing to climate, soil, food, drink, or other natural conditions, and in part to man's directing care and his selection for particular qualities. Man's wants change, and what is of more importance in this connection, *fashions* change, and old breeds are modified or new ones made to meet the new wants or satisfy the new fashions. The breed of race-horses known as the English Thoroughbred was made in the last century in obedience to special conditions, part

natural and part social, and the trotter is another instance of this kind of evolution.

The American trotting-horse cannot yet be called a definite breed; it is rather a most instructive example of a breed in the process of formation, a new breed just being moulded into shape by a curious combination of influences. To trot fast has not heretofore been natural to horses; we are in the act of making a breed in which it is the natural gait when at speed, and the next century will see a breed of trotters with two-minute horses as common as one minute fifty second runners now are. The breed is in process of evolution, in obedience to definite laws, to meet wants imposed by the new phases of our modern civilization.

Although applied to a great multitude of uses, down to a hundred years the horse has had its greatest value as an implement of war and of ceremony. All other uses were subordinate to these. For these he was doubtless brought into Egypt, for these Solomon imported horses, and Greece, and Spain. and England,—for these uses there are government establishments for breeding and improving horses in most European countries to-day.

Until artillery and baggage-wagon trains accompanied armies, the war-horse was emphatically a horse for riding. Chariots were sometimes seen, but their use was but as a trifle compared with the great use of the horses. which was to carry a rider or to carry a burden—that is, riding-horses and pack-horses. For this, the best animal is one not too large; it must have strength, endurance, intelligence, courage, and if for riding, a variety of gaits. This last is a most desirable quality, that the change of gait may be a relief to both horse and rider on long marches. Any one who has had to ride by the hundred leagues on a stretch knows what that is. With this, as well as with pack-horses, I have had a feeling, personal experience, having in one work ridden horse or mule over twelve thousand miles. This very week, an aged man, talking of his long business trips through the south sixty years ago, told me of an especially excellent horse "with four gaits."

The horse of war and the horse of ceremony remained for ages essentially a *riding-horse.* For this use certain Oriental breeds have been noted from ancient time—the Persian, Arabian, Turkish, and the Barb—and their blood is mingled in various modern breeds, still constituting the best riding horses in the world.

Besides their physical characters, their dispositions and instincts

especially fit them for companionship with man. Between the *driver* sitting in a wagon and the beast which hauls it along the road there can be no such companionship and sympathy as between the *rider* and his horse. Each feels the every motion of the other; each knows the other's thought; the two seem as but one creature, with a single brain and a single purpose. The centaur is a creature of the poet's imagination, but it comes very near a reality.

What an important role the riding-horse has played in the history of mankind can only be appreciated by a study of horses along with the nations. Take, for example, the history of Mohammedanism. Mohammed and his followers swept wherever the Arabian horse and his armed rider could tread, and no further. Other peoples had pushed their conquests by sea as well as by land; but by the horse and on the horse the Mohammedan conquests were made; the horse was the real standard-bearer of the crescent, and where the Oriental war-horse was stopped the spread of Mohammedanism was stayed.

The Moors went through Spain on their Barb horses, and when they were driven back, after several centuries of occupation, it was the men, not the horses, that went back. Their blood remained, and made the Spanish horse the most noted of Europe, and what part they played in the wars of the times is the theme of many a Spanish ballad. When the Spanish horse was at its best, then Spain was at her height among nations; and as her horses declined, her glory waned.

The Spanish adventurers brought their horses to America, and what part they played in the conquest of Peru and Mexico forms one of the most picturesque features of those cruel days. Those Spanish horses were the progenitors of the wild and half wild breeds which later spread from Patagonia and the plains of the Plata on the South to the West Indies on the east, and the valleys of California on the north. The native Californian horses to this day show traces of their Barb origin through all the changes of form and vicissitudes of fortune, and of their riding qualities I have a vivid recollection of some thousands of miles upon them.

From Mexico the Indians of the plains derived their horses. In earlier days dogs were the only beasts of burden with which the feeble tribes followed the buffalo in its migrations. The old Catholic Fathers have told us what the Indians then were.

Volney, an educated Frenchman, who made a trip in the far West in 1795 to 1798, has told us what they were even then. He compared those western plains to Tartary, which he had also visited, and says "the likeness would be completed could we see its natives metamorphosed into horsemen," and adds that "this transformation has begun to take place within the last twenty-five or thirty years" among the Sioux, who were beginning to be mounted on Spanish horses derived from Mexico, and he prophecies that "in half a century more these new Tartars will probably become formidable neighbors, and the settlers beyond the Mississippi will encounter difficulties totally unknown to their ancestors." (*Volney's View*, p. 24.) We know all too well how this prediction has been fulfilled. With only dogs and buffalo the tribes were feeble and little to be feared; but with horses they became a new people—the Arabs of America, and the most formidable foe that European civilization has met with in her western march.

The Spanish horses were carried to England to improve her breed of war-horses, and were an important element in the rise of British power. And they went to Holland, and France; and wherever they went they helped increase national power and national wealth.

But remember all this is about a horse *to ride;* a horse that would walk when in no hurry, or trot, amble, rack, or canter on the march to relieve his own or his rider's tired muscles, or on the run sweep down on the place of the enemy like a whirlwind, and then retreat as swiftly should that be necessary.

Only a running-horse is fit for such work. Try to imagine an Indian raid or an Arab foray on trotting-horses; the very idea strikes one as ludicrous.

Even in Europe the want was essentially the same. With the use of heavy armor in the Middle Ages a heavier animal was needed; yet he was a *charger*, a prancing, galloping steed. Imagine a crusader of old, clad in steel, rattling to the charge on a trotter; the suggestion provokes merriment.

Even in later times, when artillery and wagon-trains became a part of armies, the want was essentially the same; the heavy horse of the dragoon was fit for the gun-carriage or the baggage-wagon.

It was the war horse that stood as the representative of his species from the days when Job's horse snuffed the battle from afar down through the days of Greek, Persian, and Roman history,

down through the middle ages, down past the wars of Napoleon, and until the locomotive began to draw armies to the battle-field. The horse for war, the *running* horse, has remained in the lead in all those countries where the road to greatness has been by war. It needed a country wooing the arts of peace and seeking greatness by industry rather than by conquest to produce the *trotter.*

In times of peace heretofore he has figured in the ceremonies and as an index of rank, or with the rich as an implement of sport or an element of luxury.

In agriculture, and as a common beast of burden he played but a minor part until within the present century, and his little part there was a sorry one. A papyrus in the British Museum tells us what a miserable lot it was in Egypt a generation before Moses wrote, and it did not change much for the better for nearly thirty-three centuries. But with the improvement in roads and the use of wagons he had a growing importance as a beast of draught, yet this did not need fast trotters until new conditions should arise, which will be noticed further on.

Fashion and sentiments in society have always been an important factor in producing breeds of improved horses, and determining the direction the improvement should take.

From the time when an ordinary Roman citizen was forbidden to use *white* horses (and doubtless much earlier than this) there has been a social factor entering into every problem of horse raising. What colored horses might be used by persons of this rank and of that, who might *hunt* on horseback and who might do it only on foot, indeed who might ride at all, and who not, have been the subject of numerous laws during all the previous centuries, and exist still in some lands not enlightened by Christianity and not possessing the modern trotter.

In all ages the use or possession of the horse has been, in one way or another, an emblem of social position with pagan, Mohamedan, Jew, and Christian alike. Even now, and in this free country, a carriage and horses means more than the convenience of getting about, and many a carriage and span in front of our churches on Sundays means much more than the convenience of it in getting there. We are told that an enthusiast went to Mentor soon after the election of Mr. Garfield to the Presidency, to urge upon him to walk to church rather than to go in his carriage. The newspapers spoke of this social enthusiast and reformer as a bore; he

was more probably a philosopher. No, a carriage and horses mean much. I say *horses*, for I know people, good Christian people, in my own city, who can ride to the store or to market behind *one* horse on week days, but on Sundays they would rather go to church on foot, or even stay at home, than go with *one* horse. They have a traditional feeling that their social position requires that they worship with *two* horses. We see an evidence of this former sentiment regarding the dignity of a span, as contrasted with a single animal, in the use of the phrase "one-horse affair," applied to anything contemptibly small.

In many countries political and social rank has been related to the possession of horses, and it is still the case in some countries. Fashions, sentiments, the customs of the wealthy, or the aristocratic classes in society (where there is an aristocracy), are the really controlling influences as to what kinds of horses are the desirable and high-priced ones raised in times of peace, and as the relative value of the war horse has declined, new breeds have to be made, or old traits developed in new directions, to meet the new fashions. Fast trotters could never be developed until we had a class of influential people, with whom it was fashionable to drive one horse before a light carriage. That class arose in this country; it does not exist even yet in many countries.

Incidental to the riding habits in the middle ages, there were many fashionable sports that depended upon horses and skill in horsemanship, some of which still survive. For none of these was the trotter suited. Try to imagine gay cavaliers riding in the tournament, and plucking the ring on trotters. Such a thing would be indescribably comic.

In those days when horsemanship meant so much, and was so much interwoven with social usages and sentiments, when the equery of the king ranked with the prime minister, when princes and nobles vied with each other in the extent and magnificence of their riding schools, when the riding school and menage was the place of most fashionable resort, there arose an immense horse literature. Some of you know what a fancy I have for old horse literature, and have seen the large collection of old and curious books I have pertaining to horses, written long ago, the oldest printed more than 350 years ago; well, I have not read them all, I will admit, but I have read very much of this literature, and scarcely anywhere do I find a good word for a horse that trots.

Some writers, like the old Duke of Newcastle, prefer a natural trotter to a pacer, but merely because "A Trot is the foundation of a Gallop;" while "An Amble being a Shuffling Action, I would have it Banish't the Mennage" (A New Method, etc., p. 153, London, 1667); but nearly all the old writers dismissed the trot with a few words, but devoted much to the amble. In fact, the trot is usually spoken of with positive contempt. In an old French ballad, "*Le lai du Trot*," it is said that those ladies who are kind to their husbands in this world, in the next may ride on beautiful ambling palfreys, but those women who are wicked in this world, in the next will have to ride trotting nags. This but illustrates the esteem in which the trotter was held.

I will not here discuss the nature of the various gaits of the horse, further than to say that in the middle ages, and doubtless much earlier, in addition to those assumed by horses naturally, there were many artificial gaits taught. There is an enormous literature relating to this. But the fashion has all passed away. As ambling was then so much more valuable than trotting, it was bred to, and there is abundant evidence that natural pacers were common, but when not natural the gait was taught.

As the canter, gallop, run, and amble were the gaits for the saddle, so the trot is the gait for the carriage, and consequently the history of the trotter is also related to that of carriages.

Chariots and wheeled vehicles of some kind have been used to some extent from the day of the Pharaohs, but in the form and shape in which we know them, they are rather modern. Coaches came into use in England in the time of Queen Elizabeth (there had been whirlicotes and various vehicles in slight use, from time to time, earlier than that), but, until long after, most traveling was on horseback. The roads, compared with those of to-day, were bad, and coaches were heavy. When King George II died in 1760, the Lord Chamberlain, the Duke of Devonshire, arrived in town in three days, having traveled at the "prodigious rate of fifty miles a day," the historian tells us. What need for a fast roadster then, or for any time previous from the dawn of history? No, the fast trotter would have found no place then; if he had existed he would probably have been neglected and become extinct.

Four-wheeled vehicles are now so numerous and universally used that we are apt to forget how very modern their common use is. The first stage route between New York and Boston was not

established until considerably more than a century after the settlement of both colonies. Lady Murray introduced the first private coach into New York about 1745, but they were scarce until some time after the Revolutionary War, and were unpopular as signs of aristocracy, and carriages were taxed as luxuries in the early days of the Republic.

The roads were unfitted to fast traveling until long after the Revolution. The Declaration of Independence of July 4th, 1776, was received at Washington's head-quarters in New York city, and at the Provincial Assembly, at White Plains, on July 9th, five days on the way, and that not considered as long for the times as five hours would be now. It took about as long for the news of the battle of Lexington to reach New York city. What need then, with such roads, for fast trotters? Now that the distance is made in a few hours by steam, we need the trotters to carry us to the station.

The greatest use of trotters is for light wagons, but these in their present form are still more modern. I have made many inquiries about this matter both in this State and in New York, the regions where the trotter originated. Moreover, my present home, New Haven, is one celebrated the world over for its manufactures of light carriages, so I think my information pertaining to this is sound. Down to the present century one-horse vehicles were usually two-wheeled, and even these not abundant, and were heavy. The present buggy with steel springs began to be used between 1820 and 1830, but they were so scarce and rare until about 1840 as to attract notice when on the street. I well remember the first one I saw, and it was eyed with curiosity.

I have carefully examined the advertisements pertaining to wheeled vehicles in the Connecticut papers of the last quarter of the last and the first quarter of this century. Steel springs of some kind were used early. In the *Connecticut Journal*, October 28, 1798, Jonathan Mix of New Haven advertises a chaise with steel springs, and in 1807 coaches and chaises with steel springs, and a "steel spring sulky," but they were uncommon, and not of the form used now under buggies.

Among the many formal statements made to me pertaining to this matter, I will cite only a few. An aged citizen, born in the last century, says that in his early boyhood there was but one four-wheeled wagon in his neighborhood (in Ridgefield), that

ox-carts were used for farm work, and chaises and gigs were used on the roads, but these were not abundant, very nearly all the travel being on horseback. About 1815 or 1820, wagons became somewhat common, and about 1830, light four-wheeled wagons ceased to be rare, but that they were usually without springs.

An aged citizen in Hartford county, a "teamster" in his boyhood, says that in his youth all the wagons were two or four-horse, and used for teaming; they were rare on the farms; that there were two chaises in his town (Simsbury), one of which belonged to the doctor, but there were no one-horse wagons until later, and the first was without springs. He first saw a light one-horse wagon with steel springs about 1828 or 1830, and in 1840 he bought one. An aged citizen of Bridgeport says that buggies did not come into common use there until after 1840. Another aged citizen near Mount Carmel told me some years ago that the first one-horse wagon of any kind in his town was introduced by his father about 1825; it had the body down on the axle, and had wooden springs under the seat. This sort of wagon appears to have been very popular, and many were used between 1815 and 1830, both in Connecticut and in New York. In eastern New York, along the Hudson river, I have had many accounts of them.

An aged citizen in Branford told me that in 1808 there were but two chaises in that town (one with and the other without a top), and that the first buggy with steel springs was introduced about 1825 or 1826, and that his father got the second in 1830, but by 1840 there were several. A newspaper account says that the first spring wagon built in Branford was in 1835. A citizen of Ledyard told me that the first buggy was brought into that town in 1840 or 1841, but that six were brought in there within a year. A citizen of Groton tells me that the first buggy he saw in that town was in 1841, but that then they came in very rapidly. This very day, talking with an aged and well known citizen of this place (Rockville) on this matter, he told me that he went as apprentice to the wagon-making business sixty-one years ago; that then light wagons were not common, and what they had were with the bodies down upon the axles, with wooden springs under the seat; that he bought a pair of elliptic steel springs, in either 1827 or 1828, for a wagon he built; that it was ten years later before they came into common use. Several carriage builders of New Haven have told me that light buggies with springs only became common about 1840 to 1843.

I have been thus particular, perhaps tedious in these details, because of their close connection with trotting events. The introduction of light one-horse wagons with steel springs is coincident with the formation of the first organizations for the breeding, training, and speeding of trotters, and such wagons only began to be common just at the time when we had developed the first 2.30 trotters. Fast trotters had to develop in a country where there was a passion and taste for the animal, and something to make a trotting sulky of, and America is the native land of the hickory as it is of the trotter. Without hickory to make our wheels of, could we have trotters with such low records as we now have? The development of trotters and of vehicles have gone on together; we did not need the fast trotter for driving, until we had suitable wagons. Without springs, no roughness escaped the traveler. My father had one of these so-called light wagons, with the box down upon the axle, and he had a mare he thought would trot a mile in three minutes. One of the most vivid recollections of my childhood is of that mare before that wagon, and a bit of corduroy road near the old home. But that was the common experience of all, and as it had been from the beginning of carriages. How often I have looked and wondered at the pictures of the ancients in their chariots. A Roman Emperor in his triumphal chariot in all his pride and glory must have been riding about as comfortably as he would have been in a modern ox cart. There was some mitigation by cushions, but no one traveled for pleasure with light carriages until steel springs came, and until then there was no need and no place for fast trotters.

And yet trotting attracted attention much earlier than that in this part of the country. I am by no means clear as to why this fancy, for fancy it was, should spring up here, but from all I can learn, it had its origin in New England and in eastern New York.

The American horse, as he was the last part of the last century, sprung from a number of sources. Over the whole of South America, the West Indies, and Mexico, it was of Spanish origin. Sir Walter Raleigh, already in his time, said that the horses of the West Indies were as fine as any he had ever seen. But in the United States the origin was more composite. Horses had been brought mostly from England, France, and Holland, a few from Sweden and from Spain, and Frank Forester has argued, from the build of some, that there must have been importations from Ireland.

The French stock went mostly to Canada, and from that province their blood filtered down into New England and New York.

Blood from these various sources mingled and gave rise to local breeds or sorts, differing somewhat in different localities, partly because of differences of the imported blood, partly from the natural conditions of the region, and partly from the breeding. One type formed in Canada, another in Vermont, and in Rhode Island we had the famous Narragansett pacers, one of the few pacing *breeds* of which we have knowledge. We have had many pacing horses, but they have not been spoken of as breeds. This is reported to have sprung from horses imported by Governor Robinson from Andalusia, in Spain, crossed on the native stock of the State. There is frequent mention of it during the last century, but the breed (if indeed it can be called a breed) has long since run out by crossing; no one seems to have cared enough for it to keep it up and improve it. It died out as the taste for trotters grew. The breed ran out much as the Morgan breed did, by out-crossing.

It is only in recent times that the efforts to improve live stock have been chiefly by keeping the blood pure. Down to very lately the common method of improving the stock of a country has been by crossing it with something else.

The almost universal testimony of writers who visited this country before the present century, is that the horses degenerated in size. This is not the place to discuss all the reasons for this, but the fact is undoubted; but if they lost in size, the testimony is equally strong that they gained in hardiness and endurance.

After the War of Independence, under a better condition of things, pastures became better, roads better, there was more wealth, more travel, and with all this a demand for better horses. The English Thoroughbred, the best race horse in the world, was then more abundantly brought in, partly for racing purposes and partly for the general improvement of horse stock, and this blood, crossed on the hardy native stock spoken of, has been the source of nearly all the best roadsters of the country, and is emphatically the source, so far as blood is concerned, of nearly all the improvement of the last ninety years.

For some cause the trotting gait became popular in this State in the last century (a similar taste sprung up in a part of Russia about the same time, and the Orloff trotter is the result). A few years ago I looked through the files of the *Connecticut Journal*

(published in New Haven), from the war of the Revolution down to 1817, column by column, advertisements and all, and noted every item pertaining to live stock. I tabulated certain facts pertaining to horses several different years between 1787 and 1802, height, colors, foot marking, gaits, etc., of all the stallions, horses for sale, strayed, stolen, etc. Some of the data may interest you.

Thus, in 1787-1789, of seventy-eight horses advertised (ten of them stallions), the height of forty were given; only two of them were above fifteen hands, and the average height of all was fourteen hands; bay was the most common color, black next. The next two years, of twenty-nine horses, ten were black; the average height of the twelve whose height was given, was thirteen hands three inches, and so on. In describing horses, the gait was often given. In the four years, 1788 to 1791 inclusive, the gaits of seventy-five are stated. Of these we have "natural trotter," twenty-seven; "trots all," "natural to a trot," "trots well," "fast trotter," "trots and canters," and "square trotter," fifteen; total trotters, forty-two of the seventy-five. There are fourteen "natural pacers," six "trot and pace," or "trot, pace, and canter," the others have varied or mixed gaits. In 1796 and 1797, of thirty-five horses whose gaits were stated, twenty-six were described as trotters; two as pacers; and seven both trot and pace. In 1802–1804, of sixty-nine horses thus described, fifty-four were natural trotters; five were natural pacers, and ten both trot and pace. A writer in *Wallace's Monthly*, July, 1879, p. 425, has noted that in the *Connecticut Courant*, published at Hartford, various Dutch horses, 1765, 1798, etc., are described as trotters.

A stallion called "Game Leg" was advertised in the *Connecticut Journal* of April 30, 1788, by William Fowler of North Guilford. and described as seven years old, bright chestnut, and "supposed to be the swiftest trotter in Guilford." This is the earliest "trotting stallion" that I know of. There are many indications that as early as the close of the Revolutionary War, there was considerable attention paid to trotting-horses in Connecticut and New York, and perhaps also the other States north of Philadelphia.

Horses were extensively bought for shipment to the West Indies, New Haven being an important port of shipment. The animals were brought here from the interior of the State, and from the adjoining States. I now live in a house built by one of the horse-shippers of a previous generation, and the large barns

and stables where the animals were stored before sailing disappeared before the march of city improvement but a very few years ago. Numerous advertisements show what kinds of horses were wanted. "A number of pacing horses wanted immediately." "Wanted, a few natural PACERS." "Cash will be paid for some pacing horses." "Wanted, a number of sprightly shipping horses, in good order, proper for the French market" (French market meaning the French West Indies). "Wanted, thirty likely young pacing horses." "Wanted, forty-five good shipping horses for the W. I.; pacers preferred," etc., etc. Such was the common run of advertisements during the last years of the last century; sometimes trotters were asked for, this want becoming more frequent after the beginning of the present century. Thus, in 1802, are advertisements: "Wanted, a number of pacing and trotting horses, for shipping." "Wanted, likely young horses, smooth pacers or single-footed trotters will suit best." "Wanted immediately! a number of likely young horses, for which cash will be paid. They must be from thirteen to fourteen hands high, stout, thickset, and *all square trotters;* bay, sorrel, chestnut, and grey colors, without any white feet." "Wanted, a number of trotting and pacing horses for the French market," etc., etc. While *pacers* are more often spoken of as wanted, yet from time to time there are wanted "trotters suitable for the French market." I have a strong suspicion that a sort of fancy for trotters had also sprung up in the French West Indies, and that our thrifty Connecticut Yankees were quick to see the profit in breeding them.

When trotting on the course began I do not know, but the first definite notice of such that I am acquainted with is the following, which I copy from the *Connecticut Journal,* New Haven, June 19th, 1806:

"*Fast Trotting.*—Yesterday Afternoon the Haerlem Race Course of *one mile's distance,* was trotted around in *two minutes* and *fifty-nine seconds,* by a Horse called *Yankey,* from New-Haven, a rate of Speed, it is believed, never before excelled in this Country.—*N. Y. Spect.*"

This is twelve years earlier than the date given by Frank Forester as the beginning of trotting for money, and this brings me to a phase of the subject I have not before even alluded to, but which is by far the most interesting for scientific study.

It is as an instrument of gambling and of sport that the trotter

has most scientific interest, because here we have the fullest details, the most abundant records, and the most exact data. The interests involved are so large, so many of the best trotters are devoted to it, so many persons are interested, so many thousands, even millions, are staked, won, or spent upon it every year, the records of success and failure are kept with such careful labor and accuracy, and the pedigrees of the winners studied and investigated with such care, that it constitutes one of the most interesting studies in biology. To trot fast has not heretofore been natural to horses; we are making it so by training and heredity, demonstrating the heredity of education and acquired habits and characters, and the records of the turf are the chief data we have for an exact and scientific study of the history and progress of the work.

The English Thoroughbred is a running horse; for this he has been bred and developed. He is very rarely indeed, a fast trotter, and usually does not trot willingly. But he has the general form for a swift horse, and those mental qualities and instincts which specially fit him for the course, and the breed of trotters that is now forming is made out of a cross between this noted breed and the common stock of the country, said "common stock" being a mongrel mixture from various original sources, as has been already pointed out.

A new breed of animals is never made by crossing two, and only two, distinct breeds, and preserving the better qualities of both. I am not aware that there is any such case on record among all of the countless breeds of our domestic animals. But new breeds are often made of *several* original breeds by a selection from the mongrel progeny. Numerous examples of this can be cited. Also, by the use of one specially improved breed on the mongrel stock of several mingled breeds. We have several examples of this also (particularly among sheep), and the trotter belongs to this category, so far as he constitutes a breed.

Some thoroughbreds have shown a special aptitude to beget trotters when crossed on this common stock. Prominent among these stands *Messenger*, who was imported about 1788, and was the sire of a numerous progeny, and he is believed to have exerted a greater influence on the trotters of to-day than any other one animal, but this has been the subject of so much talk and writing, I will not follow it any further than to say that I have no doubt of the truth of the general fact.

There was little horse-racing in early times in the northern colonies. The colonists who settled along the coast from Delaware Bay to the Bay of Fundy were largely religious enthusiasts, who had little sympathy with this sport. In the Old World they had mostly belonged to the middle class of society, the producing class, the thrifty class. In the minds of English Puritan, French Huguenot, Dutch Walloon, and Scotch Presbyterian alike, horse-racing was associated with aristocratic privileges and unthrifty ways, if not with the worse objection of immorality. It was among this stock that the love of trotting began. The trotter could never have originated south of Mason and Dixon's line, where horse-racing was more popular, nor indeed in any country where horse-racing was a fashionable sport with the better class of society. The taste had to arise where running was under a cloud.

After the Revolutionary War, during the last years of the last century and the first years of this, a considerable number of English thoroughbreds were imported, both for running and for improving the horse stock of the country by crossing. Horse-racing rapidly grew in favor, particularly in the Middle States, as we had an increasing number of men who could afford to indulge in the luxury.

But old prejudices remained, a strong reaction took place, and the sentiment against horse-racing became so powerful that most, if not all, of the Northern States passed stringent laws against it, with heavy penalties of fines or imprisonment. As an illustration of the sweeping prohibition attempted, I will quote from the laws passed in Pennsylvania about 1820, which not only forbade horse-racing itself, but also forbade even to "print, or cause to be printed, set up, or cause to be set up, any advertisement mentioning the time and place for the running, pacing, or trotting of any horses, mares, or geldings, or shall knowingly suffer any advertisement, as aforesaid, to be set up in or upon his or her or their dwelling-house," etc., etc. A law similar in character existed on the statute books of this State until three years ago, when it was repealed. The effect of these laws was to discourage the importation of thoroughbreds, and Frank Forester states that, as a consequence, there were fewer in the country in 1850 than in 1820.

There was some racing in most of the States (less in Connecticut, and consequently her horse interests declined) in spite of hostile laws, but the sport was under a cloud, and trotting apparently

came in to supply its place. I am inclined to believe that the desire to see a horse go at its best speed is an instinct with our race, and means will be found to indulge it, even under the most hostile laws.

Frank Forester says that trotting *for money* began in 1818, and grew out of a jockey-club dinner at which Maj. Jones, of Long Island bet Col. Bond, of Maryland, $1,000 that "no horse could be produced that could trot a mile in three minutes." There was much side betting, and the odds against it were immense. But *Boston Blue* won handsomely, and Maj. Jones lost his thousand dollars. This trot made much talk at the time, and an account says that this wonderful horse, which could trot a mile in three minutes, was taken to England to exhibit there. This was a *trot against time*, but time had been taken earlier. I have alluded to the trot of Yankey in 1806, and the London Sporting Magazine of October, 1810, is cited as having a letter that tells of a trot in August of that year, in which "a chestnut horse from Boston" trotted to a sulky one mile in 2.48½, for $600. Doubtless there was occasional trotting, just as there were other queer races, just as we hear of a hog-race, and a goose-race; but trotting as a sport may be said to have fairly begun between 1815 and 1830, and they were frequent enough before 1820 to be specially mentioned in prohibitory statutes. Under the repression of hostile laws against *races* other means were taken to gratify the instinctive pleasure of seeing horses get over the ground swiftly. A *race*, as then understood, was a contest between two or more horses, to see which could run the fastest, as it is still in most countries. Men did not dream of a *race* being run by *one* of anything, be it in a horse-race, boat-race, or foot-race. Moreover, in those times *horse-racing* meant *horses running*. So when horse-racing was a crime punishable by fine and imprisonment, the good, law-abiding citizen who owned a good trotter and who instinctively yearned for the pleasure of seeing a spirited horse in action, would not *run* him, nor *race* him, he merely "trained" him, and had an occasional "*trial of speed*," in which he could hold his watch and see how long it took his horse to trot a given distance, and the "timing" of trots became common long before the system of records was established.

New York had passed "An Act to prevent Horse-racing," March 19, 1802, which was amended March 30, 1821, by which it

was enacted "that from and after the passage of this act, the training, pacing, trotting, and running of horses upon regulated courses and upon private property in the county of Queens, is hereby declared to be exempted and free for five years from the provisions and penalties of an Act entitled an Act to prevent Horse-racing," etc. (*Revised Statutes*, N. Y., Ed. 1836, III, p. 282.) The races were allowed only in the months of May and October, and Section III provided that the sheriff of the county should be on hand at these "trials of speed" (as the statute calls them) to see that all was conducted in a way conducive to good morality. When this amendment expired by limitation, it was re-enacted, April 3, 1826, extending the privilege for ten years, and until March 30, 1837 (*ib.*, p. 283), and in 1834 another amendment allowed "the trials of speed authorized by law in the County of Queens" to take place between the first day of April and the fifteenth day of June, and between the first day of September and the fifteenth day of November of each year. It is only just to say that "trials of speed" were finally declared by statute to be horse-racing and liable to the penalties thereof unless exempted by special act.

I have been thus particular in giving these dates, because it marks an epoch in the history of trotting. It is the beginning of organizations for the special improvement of trotting-horses, although the provisions nominally extended to pacing and running also.

The New York Trotting Club was organized in 1825, with a view of *improving the speed of road-horses,* as the old racing-clubs and jockey-clubs had been to improve *riding*-horses. Their course was near Jamaica, L. I., about a mile from the old Union course, and was probably the first *trotting*-course in the world. The Hunting Park Association was formed at Philadelphia in February, 1828, and the next year measures were begun for a trotting club at Baltimore, and then organizations spread rapidly. The *American Turf Register* began in 1829, and recorded the trots, and by this time, or certainly by 1830, trotting may be said to have become an established sport, rapidly increasing in popularity. There was for a time a feeling with many that it was a sort of rustic sport, fit for the masses, as running had been for the wealthier classes. But that very thing, that it was adopted by the masses, was a great gain in the end.

By this time the names of a score or two of horses became well known to the public as trotters, many of the names as plebeian as the sport was held to be. We hear of Betsey Baker, Bowery Boy, Bull Calf, Burster, Ephriam Smooth, Jerry, Jersey Kate, Paul Pry, Rattler, Rob Roy, Sally Miller, Screwdriver, Top Gallant, Whalebone, and a score of others, now this one to the front and then that. Top Gallant (foaled about 1806) was perhaps the most popular horse of his day. He does not appear to have won much nor often, yet, like some politicians, he preserved his popularity for all of that, and his time, 2.40 (although beaten the same year by the Treadwell mare), was the slang phrase for speed for twenty years later. He lived to a good old age (as so many trotters have done), and it was claimed that when nineteen years old he could still trot in 2.45 with a man weighing 150 pounds on his back (*Am. Turf Register*, Nov., 1829, p. 122). In 1832 Burster trotted in 2.32, and then became affectionately known as "Old Buster." Next came Edwin Forrest, who lowered the time to $2.31\frac{1}{2}$ on the Centerville course, L. I., May 9, 1834. This track was too long; if allowance be made for this, the time for an actual mile was nearly a second better; but as it was it took nine years more to beat it, when Lady Suffolk lowered the record to below 2.30.

I have used, for convenience, only the mile records. Were we to consider all the performances, the best horses and the best records would not coincide with my list. In those early days most of the trots were for distances greater than one mile, usually for two, three, or four miles, often longer, and moreover, before 1840, most of the trotting was under saddle, while now it is mostly in harness. The time came to be more and more carefully kept, and thus "records" became an established feature.

As this is a distinctive American custom, and began with the trotters, I will notice it more fully. Records are not kept in England, and because they are not, we cannot study the development of the race-horse as we can that of the trotter. I have already shown how speed was noted by timing; later specific rules were established, and now a word of explanation to the innocent as to what a "*record*" at present means.

The laws of sporting are very exact, the code is planned with more care, deliberation, and wisdom than most of our national and state laws are, and in the racing code of this country any contest

for a purse, premium, prize, stake, or wager, on any course, and in the presence of a judge or judges, constitutes a public race. The time made by the winner is a "record." There is no record unless the horse wins, so a list of records does not tell how fast some of the horses may have trotted; they may have done better than their record, and not winning, get no credit for it. Or a horse may trot never so fast, and if there is no money or prize won that is no record. To illustrate—Dexter made his record of 2.17¼ at Buffalo, Aug. 14, 1867, by winning. But in June of the same year, with Ethan Allen as a *running mate*, he was timed a mile in 2.16. This is well authenticated, but is no "record." Again, Edwin Forrest in August, 1878, at Hartford (the day of a great feat by Rarus, and I dare say several of my hearers were present), trotted a mile in 2.14½. There were many thousands of spectators, judges in position, the time as carefully noted as in any race in the world, another horse trotted with him to encourage him, yet his time made was no "record," because there was no "purse, premium, prize, stake, or wager" involved. It was a mere exhibition. Consequently, the story of the trotting horse is much better in fact than can be shown by any table of records. But as these are the only exact and well authenticated data we have, I use them, and because of the uncertainty of many alleged times which are not records, I must ignore all such in this discussion.

Records only dropped below 2.30 in 1843, in which year Lady Suffolk (and Beppo?) trotted in 2.28, but it had often been claimed to have been made before. It was claimed that Bull Calf did it when six years old (*American Turf Register*, Jan., 1830, p. 257), and several horses had trotted one mile of a longer race, in less than 2.30. Dutchman, in a match against time on the Beacon Course, Aug. 1st, 1839, made the second mile of a three mile race in 2.28. His record of 7.32½ for the three miles, under saddle, made at that race, still remains the best of its kind, 3-mile heats under saddle having long since become very rare. But times, even when not records, were valued *for driving purposes* quite early. A note by the editor of the *Am. Turf Register*, June, 1830, p. 483, says that in New York or Philadelphia a horse is so commonly estimated by his performance at trotting, that "if you ask an ignorant stable boy 'what sort of a horse is that,' he will answer, 'well, I guess he's a three or a three and a half,' meaning so many minutes, and seconds for a mile." The *Ameri-*

*can Turf Register* was established in 1829, and with that, records in our present form may be said to have begun, although the "*Trotting Record: containing a list of all published performances in which any heat was trotted in 2.40 or less from the earliest dates,*" in Wallace's *American Trotting Register*, I, p. 325 to 468, I think, cites no records earlier than 1830 as worthy a place there.

Just as records became an established fact, light steel-spring wagons began to be made, and between 1835 and 1845, driving to light carriages became exceedingly fashionable, particularly about New York. Several European travelers of that time speak of it as a curious fashion, and being unknown in England, they did not speak of it usually with admiration. The old prejudices against trotting lingered, and a writer in *The London* (New) *Sporting Magazine* for July, 1839, speaking of sporting in the United States, where "*trotting* is the order of the day," says "our cousins on the other side of the salt water are mad in the encouragement of that nasty, awkward, ugly, Chelsea-water-works-style of action which characterizes the fast trotter." He allows, however, that "there is method in the madness," and that the best trotters bring big prices.

Although I have brought the history down to the time when there was only one (or two ?) record in the world of 2.30, the story is nearly told. A famous capitalist is reported to have said that it was easier to make a thousand dollars out of one than one out of nothing. It appears to have been just so with trotters. It took from 2200 B. C. to after A. D. 1800 to produce one three-minute trotter,—many thousands have been produced since.

I invite your attention now, specially to the two tables I have hanging on the wall. The first is a *Table of Best Records* (see p. 228), showing progress in the rate of speed, from Yankey in 1806, to Maud S. in 1881, the earlier ones on the list, it must be understood, not being authenticated records in the sense that term is now used.

TABLE OF BEST RECORDS.

| | | |
|---|---|---|
| 1806. | Yankey, | 2.59 |
| 1810. | A horse from Boston, | 2.58½ |
| 1818. | Boston Blue, | 3.00 |
| 1824. | Top Gallant, | 2.40 |
| 1824. | The Treadwell Mare, | 2.34 |
| 1830. | Burster, | 2.32 |
| 1834. | Edwin Forrest, | 2.31½ |
| 1843. | Lady Suffolk, | 2.28 |
| 1844. | Lady Suffolk, | 2.26½ |
| 1852. | Tacony, | 2.26 |
| 1853. | Tacony, | 2.25½ |
| 1856. | Flora Temple, | 2.24½ |
| 1859. | Flora Temple, | 2.19¾ |
| 1865. | Dexter, | 2.18¼ |
| 1866. | Dexter, | 2.18 |
| 1867. | Dexter, | 2.17¼ |
| 1871. | Goldsmith Maid, | 2.17 |
| 1872. | Goldsmith Maid, | 2.16¾ |
| 1874. | Goldsmith Maid, | 2.14 |
| 1878. | Rarus, | 2.13¼ |
| 1879. | St. Julien, | 2.12¾ |
| 1880. | Maud S., | 2.10¾ |
| 1881. | Maud S., | 2.10¼ |

The following "*Table; showing number of horses, with their records*," (page 240) shows at a glance the number of fast trotters which have trotted with the several records since 1843, when we first began to have a 2.30 class. In explanation of this table, I will say that from 1873 on, I have used the figures given by others, only the arrangement and collation is mine. For the figures from 1843 to 1871 inclusive, I am responsible. The first list of 2.30 horses known to me, appeared in *The Turf, Field, and Farm*, vol. XVI, p. 117 (February 21, 1873). A writer over the signature of "Ajax" published a list of 323 names, with their best records, arranged in the order of the records. This list must have cost him much labor, but being the first of its kind, and from the intrinsic difficulties of the case, it was very imperfect, so much so that I do not here use the figures. But it was a beginning which "Ajax," and others later

improved, and from that time lists of 2.30 horses in some shape, have appeared each year, the lists of 2.25 horses being quite numerous and prepared with much care. For the figures up to 1871, I have gone over the printed records to that date, and made a card catalogue of the 2.30 horses year by year, with the records as published. To make the showing as good as possible I have included in my figures records under saddle, and records with running mate, except two which affect the best records of their respective dates. Moreover, I have not carefully weeded out all where the track was too short or for a few other technicalities. Hence my figures are larger in several cases than the strict records, according to the rules of to-day, would allow But as the table has been prepared as a study in the evolution of a breed, and the figures are for relative use and comparison, their value for this purpose is not impaired by this kind of inaccuracy. I can only say that they are approximately correct, that they have cost me in the aggregate some months of labor, and that absolute accuracy is now out of the question. The printed reports abound in so many errors, typographical and otherwise; there are so many irreconcilable statements, so many disputed points where experts differ, that no table will probably ever be made that will be accepted by all as entirely accurate. A better one can probably be made when *Chester's* forthcoming "*Complete Trotting and Pacing Record*" shall have been published, if any one will carefully collate all the "35,000 events," and I hope in the interest of science some one will have the time and inclination to do it. The following table is the only one of its kind I have yet seen, and inaccurate and imperfect as it may be, and must be from the very nature of the case, nevertheless it is the most interesting series of figures ever yet brought together, illustrating the evolution of a breed.

TABLE—Showing Number of Horses, with their Records.

| | 2:30 or better. | 2:27 or better. | 2:25 or better. | 2:23 or better. | 2:21 or better. | 2:19 or better. | 2:17 or better. | 2:15 or better. | 2:13 or better. | 2:11 or better. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1843 | 1 | | | | | | | | | |
| 1844 | 2 | 1 | | | | | | | | |
| 1849 | 7 | 2 | | | | | | | | |
| 1852 | 10 | 3 | | | | | | | | |
| 1853 | 14 | 5 | | | | | | | | |
| 1854 | 16 | 6 | | | | | | | | |
| 1855 | 19 | 6 | | | | | | | | |
| 1856 | 24 | 7 | 1 | | | | | | | |
| 1857 | 26 | 7 | 2 | | | | | | | |
| 1858 | 30 | 7 | 2 | | | | | | | |
| 1859 | 32 | 9 | 2 | 1 | 1 | | | | | |
| 1860 | 40 | 11 | 4 | 2 | 1 | | | | | |
| 1861 | 48 | 14 | 4 | 2 | 1 | | | | | |
| 1862 | 54 | 17 | 7 | 4 | 1 | | | | | |
| 1863 | 59 | 19 | 9 | 4 | 1 | | | | | |
| 1864 | 66 | 22 | 12 | 4 | 1 | | | | | |
| 1865 | 84 | 29 | 15 | 5 | 2 | 1 | | | | |
| 1866 | 101 | 32 | 17 | 6 | 3 | 1 | | | | |
| 1867 | 124 | 42 | 21 | 9 | 5 | 2 | | | | |
| 1868 | 146 | 52 | 28 | 13 | 6 | 2 | | | | |
| 1869 | 171 | 63 | 34 | 15 | 10 | 4 | | | | |
| 1870 | 194 | 72 | 35 | 16 | 11 | 5 | | | | |
| 1871 | 233 | 99 | 40 | 17 | 12 | 6 | 1 | | | |
| 1872 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | | | |
| 1873 | 376 | ...... | 74 | 28 | 15 | 5 | 2 | | | |
| 1874 | 506 | ...... | 98 | 40 | 16 | 11 | 5 | 1 | | |
| 1875 | ...... | ...... | 134 | 61 | 30 | 13 | 5 | 2 | | |
| 1876 | 794 | ...... | 165 | 81 | 39 | 16 | 6 | 2 | | |
| 1877 | 836 | ...... | 214 | 105 | 51 | 19 | 8 | 2 | | |
| 1878 | 1,025 | ...... | 270 | 129 | 68 | 24 | 9 | 4 | | |
| 1879 | 1,142 | ...... | 325 | 164 | 88 | 33 | 11 | 5 | 1 | |
| 1880 | ...... | ...... | 366 | 192 | 106 | 41 | 14 | 6 | 2 | 1 |
| 1881 | 1,274 | ...... | 419 | 227 | 126 | 49 | 15 | 7 | 2 | 1 |
| 1882 | 1,421 | ...... | 495 | 275 | 156 | 60 | 18 | 8 | 2 | 1 |

Let us now return to the subject of the best records, with the table before us: Lady Suffolk began the 2.30 list in 1843 (over 1,400 have since dropped into that class), and the next year lowered the record to 2.26½. It took eight years to better that, but in the thirty years that have elapsed since that record was lowered some 600 or 700 have done better, and many thousand heats have been trotted in less time. It has often been made with teams on the highway.

Then Tacony came and twice lowered the record, but he never

created the enthusiasm his successor Flora Temple did. She lowered the record to 2.24½ in 1856, and again to 2.19¾ in 1859. We began now to have a 2.20 class, and what an enthusiasm it created! Flora Temple became a household word—ladies wore Flora Temple bonnets, boys smoked Flora Temple cigars, politicians drank Flora Temple whisky. It is not probable that any one trotter will ever again create such enthusiasm. She died only five years ago, in her thirty-third year. I have seen several statements as to her winnings, which were large. Then came Dexter, lowering the record twice before retiring from the turf; then Goldsmith Maid, whose speed and fame are said to have brought her owners near a quarter of a million of dollars; then Rarus, St. Julien, and Maud S.

We have followed this evolution through. We have seen the sentiment starting, apparently in New England, which produced the earliest trotters, then spreading to the Middle States, where it had its greatest growth, and then it spread through those parts of the world where there are good roads and light carriages. It has been claimed that trotting was started first in Italy. Projects for trotting courses were advocated in France as early as 1834, and in Normandy in 1832, and there has been a slow development in various countries of Europe. But the real development has been here; although now there are trotting courses in most civilized countries of the world. I received last year trotting records in Norwegian.

We have traced its growth and seen what a combination of causes has been at work in society aiding in the development: sentiments against horse-running, and a taste for trotting taking its place; a few French West Indians wishing trotters rather than pacers (possibly because better broken to the gallop); improvement in wagons, and the invention of steel springs; a fashion arising of driving horses single; hickory to make light wagons of; the needs in our modern city business requiring quick roadsters; changes in the methods of war; introduction and widespread use of railroads for quick travel and heavy transportation; the spirit of the age, etc., etc., have all been factors in this most interesting problem; factors, the separate value of which would be very differently estimated by different persons viewing the subject from different standpoints.

Professor Marsh has shown us how that the horse has developed

in previous geologic ages from a small, weak, and awkward animal; how that growing in size, and strength, and fleetness, and beauty, the developed horse was on the planet ready for man when he came, I have tried to show how man has taken this and modeled it into something even better and higher; the trotter being the latest and best.

The horse of old was the horse of the warrior, and was bred for the battle-field or for ceremony, and his use and possession was for the wealthy. The trotter originated among the masses so soon as the masses were free; he developed for use as well as luxury, the horse for both business and pleasure, the horse alike for the bustle of the busy streets and for the quiet family carriage. The horse of old was the horse of war and of waste; the trotter is the horse of peace and of thrift, the highest equine product of the modern highly developed Christian civilization.

The Chairman stated that an invitation had been received from the Second Congregational Church of Rockville to hold the closing session of the Convention in that church, and on motion of Mr. Webb, seconded by Dr. Riggs, the invitation was unanimously accepted.

Mr. Gold. I find this question in the Question Box: Can spent shell lime, used in gas works, be purified and made valuable as a fertilizer, and if so, how?

Mr. Augur. I would give my experience, though I cannot give an affirmative answer. Some years ago, I used a number of bushels of gas-lime, but before using it I let it lie a year or two, thinking that by doing so I would get rid of the acrid properties. I did not see any benefit from it, and where that heap lay (which was on a piece of ground where we have strawberries), although it was several years ago, strawberries utterly fail to grow, though doing remarkably well everywhere else. I consider that the use of that lime was an actual damage to me.

Dr. Riggs. I had a friend in Hartford who used gas-lime from the gas works, and it played the mischief with his corn. He put it on some three or four acres, and got nothing from it. It ruined the piece.

Mr. Kirkham. A number of years ago, my father put it around some nice Baldwin apple trees, six or eight inches through, and it killed every one of them.

Question. Is it of the greatest importance to the farmer to breed horses for speed?

Mr. Wetherell. I think it is for the interest of the farmer to breed horses that he can sell for the highest price. If it is speed that commands the highest price, then breed for speed.

Mr. Hart. Without any regard to the expense of breeding and raising them?

Mr. Wetherell. The farmer is always to think of those things when he is breeding.

Mr. Allen. I fear that this lecture, excellent as it has been, and containing the vast amount of information that it does, with which we have been so much delighted, may have the effect to induce some young farmer, by the statements made of large sums of money which have been won by some noted trotters, to invest his money in the attempt to breed fast horses. I have had a little experience in this matter myself, and I have seen others who have had some experience in it, and I am satisfied that where one man has succeeded in raising a trotter that has brought him a fair remuneration for his expenses, ten men have lost all the money they put into it. It is not good policy for farmers to undertake to breed trotters, for the reason that out of twenty well-bred colts, that have their blood tracing back to some Arabian horse over in England, and that have been bred right up to the trotting mark, you will not get one that can trot in less than three minutes; and where you get one, it is uniformly the case that he has been trained by some expert to trot in that time. I saw an article not long ago from Mr. Bonner in reference to one of his horses, and he said if that horse had not been shod with heavy toe-weights, it could not have trotted in three minutes; now it is going in 2.10. A large per cent. depends upon training, shoeing, etc., and if anybody supposes we are going to have a race of trotters in

America that will naturally go in 2.20, or 2.10, or two minutes, any time this century or the next, he will be terribly mistaken. It cannot be done.

QUESTION. Has any person in this convention had any experience in plowing in rye, buckwheat, or any other green crop, for the purpose of keeping up the fertility of the soil, and, if so, will he give the result?

MR. ——. The best way is to harvest the crops. You will get money enough to pay for fertilizers.

MR. MERRIMAN. I plowed in a heavy crop of clover once, that would have yielded five or six tons to the acre, and put tobacco in after it. My tobacco was very poor. I thought the next year I would get the value of the clover. I planted tobacco again, but I did not see the value of the crop of clover I plowed in, and never have.

MR. MORRIS of Willington. About twelve years ago, I plowed in a very heavy crop of clover. I had corn on it afterwards. I plowed in, in the course of fifteen years, three crops of clover, and manured the crop once in the hill. One year, I spread on a light dressing of manure. At the end of that time, the land was much better than when I bought it. I also took one piece of ground (my land is sandy), plowed in a crop of clover, and used some fertilizer, and there I had the best grass I ever had on the farm.

MR. ALLEN. The way in which they keep up the fertility of their wheat fields at the West is by plowing in clover and lime. They do not use any other manures, and their wheat fields are growing better and better every year. I think it is one of the best means we can employ to renovate our old fields that are lying about us here unproductive. There is nothing that will go down deeper or prepare the soil better for crops than a good crop of clover.

MR. GILBERT. Here, in New England, we are obliged to look at questions of this character from an economical standpoint, and this question as to the propriety of plowing in or fertilizing our soils by returning the crop to the soil, certainly should be looked upon from this point of economy. There

is not the least question that a clover crop, or any other crop grown on the soil, plowed into that soil, returns to the soil all that the crop contains. Yet is it economy to do so, with the clover crop, one of our best forage crops, and with the fact that our agriculture is based on animal or stock husbandry, in its various branches, and that we are able, through stock husbandry, to feed out this product at a profit, furnishing to the feeder, through the economy of the animal to which it is fed, the market value of the product? Then, considering that in the voidings of that stock you have returned to the soil a large percentage of the fertilizing material which existed in it, you have certainly the matter of economy introduced. If the clover crop, rich in nitrogen, rich in fertilizing material, one of the most valuable elements we have to deal with, is fed to your animals, from 80 to 85 per cent. of the fertilizing material contained in it is thrown off in the waste of the animal, and through proper economy on the farm that can be nearly all returned to the land. Thus you have the profits of feeding, and you have from 80 to 85 per cent. of the fertilizing material left upon the farm. As a matter of economy, shall you return the entire crop, or will you feed it, and return the resulting manures? I think the latter course commends itself to the good judgment of every individual.

QUESTION. I had but one hive of bees in the cellar the first of September, and took them out the first of the following April. They lost in weight while in the cellar ten pounds; also lost fifteen pounds in weight while out of the cellar, May first. Did I remove them too soon, or not? Which is best, to bury the bees in the winter or keep them in a cellar?

MR. JEFFREY. There are three or four questions combined in one. He asks, first, whether he took them out too early, because the consumption of honey, or apparent consumption of honey, by weight, between the first of April and the first of May, was greater by five pounds than from the first of December to the first of April. While in the cellar, from the first of December

until the first of April, they consumed ten pounds of honey to keep up the animal heat and sustain the hive. After they were taken out of the cellar, they consumed, by his weight, fifteen pounds of honey in the space of one month. That decrease was not in honey wholly. There were left in some of the cells of the comb, at the time of taking out, some bees that were dead. There were some bees that were old, so that when they began to fly, they were worn out by old age, and were lost. There were not, most likely, by actual count, over one-third the number of bees in the hive at the end of the month that there was when they were set out. There was a decrease in honey and a decrease in bees, and the cleaning out of the hive is to be considered in making up the fifteen pounds decrease in weight. They did not, and could not, consume fifteen pounds of honey in the thirty days, at that season of the year.

He did not take them out of the cellar too soon, provided it was warm enough for them to fly. Burying them, unless in a very dry spot (as he asks which is best, to bury them or keep them in a cellar), has a tendency to produce mouldy and rotten comb, which will invariably produce the disease called "foul brood," which is as contagious among bees as typhoid fever is among the human family.

QUESTION. Has any one present ever had any experience in feeding apple-pomace to stock?

Mr. WETHERELL. My farmer has fed it to milch cows, with advantage. A farmer who furnishes milk for the Boston market, out on the Fitchburg road, who lives near a cider-mill where a very large quantity of cider is made, takes special pains to secure the pomace. He feeds it regularly to his milch cows, increasing the quantity of milk thereby, and does not discover that it impairs the quality thereof. He regards it, therefore, as a valuable feed for his cows when in the stable.

Mr. AUGUR. If I understand rightly, the experiment station has made analyses, which have been published, showing the value of apple-pomace.

Mr. Gold. My experience in feeding apple-pomace is not very extensive, but perhaps it will be well here to state that of Mr. Dickerman, of Hamden. He has a powerful cider-press, one of the modern style, in which he is not obliged to use any straw. The pomace from his mill is thrown in a large heap, and, pressed down by its own superincumbent weight, it becomes ensilaged; it comes into the condition of preserved or dried fruit, and his horses and cattle eat it greedily, and are in a thriving condition while consuming it. Samples of it were taken to the experiment station and were analyzed, and it was found that this apple-pomace, taken in this partially dried and cured state, the next spring, analyzed very favorably in comparison with many of our other feeding stuffs. Mr. Dickerman has continued for several years to feed it, and, as I have heard, with satisfactory results.

Question. If a thoroughbred cow is served by a scrub bull, the resulting product is a grade. Does it affect the after progeny of the cow?

Col. Warner. I have no doubt, in fact I know, from my own experience in breeding, that if a thoroughbred cow, of any particular breed, is served by a common scrub bull, the effect of that can be distinctly traced in the progeny of that cow for two or three generations. I have had it so in two instances where the cow was a Jersey and the bull a common bull of the country. I know it can be traced, especially in the case of heifers with their first calf; I don't think it can be in cows after they get to middle or mature age, but I know it can be with heifers. I have in my herd some heifers that have been served by a grade Guernsey bull, and the next service was by a Jersey, and the second calf was marked quite strongly by the first bull; I traced it very distinctly. The peculiar marks of the first bull were noticed in the second calves of these heifers. It is so in regard to dogs. If one is served by a cur dog for three or four litters, that slut is good for nothing. Breeders of dogs, I believe, understand that pretty thoroughly.

Mr. Allen. Col. Warner is exactly right, as I know from my own experience. I have bred fine stock for a good many years, and I know it is not a safe thing to do. Every careful breeder avoids it, who knows what the result will be. The effect is this,—that impregnation from a scrub bull, of whatever breed, is ruinous to the after progeny of the cow.

Dr. Riggs. About fifteen years ago this same subject was up in this Society, and I recollect stating at that time what I had read in regard to an English experiment. A gentleman there had a quagga, an animal resembling the zebra, with stripes around his body. He was crossed on a mare and she had colts that resembled very much the sire, with some of the characteristics of the mare; and every colt that she produced after that had stripes around its body plainly and distinctly to be seen, though the sire of the other colts was a horse. The object was to test the thing. This matter is well understood down South. A negro and a white woman produce, of course, a cross-breed, and the woman after that, it is well understood by the Southern people, never can have a pure white child. Her children will all have the characteristics of the negro blood in them.

Question. Is it advisable for Connecticut farmers to raise sorghum?

Mr. R. Powers, of Bolton. I have heard quite a number of our farmers speak unfavorably of it, and some, who are very enthusiastic over other crops, say, "No sorghum for me." I look upon it just in this light: they don't know anything about it, any more than people who are prejudiced against the Storrs School. I undertook to raise it for the first time last year, but I was not successful. I had so much other business on hand that I did not attend to it in time, and it did not mature; I could not do anything with it, and I condemned it. This year I was persuaded by my neighbors to try a little, but I was rather opposed to it. My wife wanted me to try some and urged me to do so, and she dropped the seed and helped to plant it. I was vexed with myself afterwards and said, "our corn crop is going to be short; I wish

I had planted corn on that ground." "I was almost ready, before it came up, to go and plant it over with corn; but for some reason I left it. I did not take any particular pains in taking care of it. I simply ran through the little patch of it that I had with a cultivator, and very carelessly hoed it,—much more so than any other crop I had. It grew very fast, and then, later, I hoed it once more. That is all I did to it. When the time of harvest came, I was more determined than ever that I would never raise any more. I took one stalk and stripped it, and my wife and children spent a whole day at that work, and she got discouraged, but we thought we would take it to the mill. That was a great bugbear in the way, for the mill was away off over the hills, and I had got to hire cattle to draw it; and the difficulties loomed up so much that I thought I couldn't overcome them. But after I obtained the syrup, I was so pleased with it, that I thought I would never say anything against raising sorghum. I have got the article, and you could not buy it of me for a dollar a gallon. My neighbors also have it, and value it very highly. One of my neighbors made cake with it that was equal to any cake made with sugar. We went to her house last winter and participated in a molasses-pull, and better candy I never made in my life than that. Another neighbor cannot make gingerbread with any molasses she can buy in the market, but with this syrup she can make the nicest gingerbread. And so I want to stand up in favor of it. I do not know of anybody from Bolton who is here to stand up for it, but every body who has raised it speak of it very highly. But people are prejudiced against it because they call it "sorghum." It is not sorghum; the proper name is "Minnesota amber cane." The old-fashioned sorghum, that was raised ten years ago, was such black stuff, and had such a tang to it that nobody liked it, and people have got the idea that this is the same thing. There is no tang to this syrup. I don't think it is equal to some syrup I have eaten, but I say, for two-thirds of the purposes for which sugar is used, this will take the place of sugar.

Col. WARNER. The syrup that was raised a few years ago was manufactured out of old-fashioned sorghum. The reason that it went into disrepute so extensively over the country, I think, was that there was a little acidity to the syrup. I have raised it extensively. They could not do without it in the South. In Tennessee and Kentucky, and in the Gulf States, they raise an immense amount of it. When they had negroes, they raised it for them. They do not mind that peculiar taste, but the educated taste of the northern people will not tolerate that acidity.

Mr. POWERS. What I have used is made by Brown & Utley, in Columbia. We all have to go there.

Mr. YEOMANS. I imagine that one reason why my friend has had such good success with his sorghum is because he took it to a good town to be manufactured. Now, in regard to the matter of sorghum, and the peculiar acidity that is spoken of after the syrup is manufactured, if you will go to Messrs. Brown & Utley, they will tell you that it is not properly manufactured. When they first commenced the manufacture they did not understand it, and the article they produced was not as good as it is at present. I am not speaking now from personal knowledge of the matter of raising this crop, because I have not raised it myself, but I know the facts in regard to it, because I have had a great deal of conversation with them, and I understand that as they have had more experience in the manufacture, they have been able to overcome this trouble, and they say it was because it was not in the first instance properly "cooked," as they put it. Now they have no trouble. All kinds of sorghum are raised there; it is not the Minnesota amber alone. The old-fashioned plant (I don't know what they call it), with a large stalk, is still raised there, and they manufacture it into syrup, and that syrup is good, and it keeps well. So far as raising it is concerned, I imagine that the gentleman who said, "none for me," was one who never raised it, and knew very little about it. A great many of the farmers of Columbia do not raise it for the purpose of making it an article of commerce of any importance, but they raise it

for their own families. You will find in a number of families ten, fifteen, twenty, thirty, or forty gallons; they would not think of being without it. In fact, there are those who prefer it to any sugar or molasses that the market affords, and, as has been stated, they use it for all purposes of cooking, and with a good deal better success than they do the average molasses that is furnished by merchants.

Mr. AUGUR. I think it is pretty generally understood that what Professor Collier prophesied so strongly at Willimantic, when he gave his lecture there, has been realized. They are manufacturing sugar with success in New Jersey and Illinois. The process or method of operating seems to be better understood, and the prospect is that it is going to be a success. There is a feeling of encouragement all over the country. I have been interested in seeing so many samples brought in here. I imagine that the best process has not been reached yet, but that there will be a continuous improvement.

Dr. RIGGS. I saw it stated in the papers that in New Jersey, where they have proper facilities, proper mills, and intelligent manipulators, they had made, the present season, a thousand barrels of sugar—fine-grained sugar, white, and as desirable as you could wish in the household, with a large amount, also, of the syrup. The fact is, I think, established beyond all question, that it is one of the best things that our farmers can raise; at least enough to supply themselves with what they want to use in their families.

Mr. BLISS, of Massachusetts. I suppose the gentlemen here in this State like to know facts; that is what we want to know in our State. Last year, Mr. D. A. Havens, now of Framingham, Mass., kept an accurate account of what he raised on his farm, and gave me the record of his amber cane. He had as fine syrup as I ever tasted, and the actual cost was twenty cents a gallon.

Col. WARNER. A gentleman here says he pays twenty cents for the grinding and the boiling.

Mr. SESSIONS. Mr. Chapman of West Springfield, who ground this cane and made this syrup which has been spoken

of, has a mill that he put up that cost him over six hundred dollars. After reading the lectures of Prof. Collier, he went into it and spent two years in developing it. He has a process of treating the juice before it is boiled down with lime-water, which kills this acid, or "tang," as we call it. Treated in that way, it will granulate, and that is the only way it can be made to granulate, as I understand it; and it removes the objection that it tastes like herb tea. The syrup that was formerly made from the old sorghum tasted like herb tea. There was a vegetable taste, an unpleasant taste, which is gotten rid of by treating it with lime-water.

Mr. Bliss. I should have said that Mr. Havens was offered, at private houses where he delivers his milk, a dollar a gallon for his syrup, and at the stores, seventy-five cents a gallon; but he made but little, just for his own use.

Mr. Wetherell. It will be remembered by some present, that this subject was referred to a special committee of the American Academy of Science; that the committee reported, and that one of them, Prof. Silliman, wrote a letter to the *New York Tribune* which was published last spring, stating that that committee reported in favor of this amber sugar cane, and of the experiments made by Dr. Collier of the department at Washington; but their report which they made was not published; why, nobody seemed to know. It is in the department at Washington.

I am exceedingly glad to hear what I have heard to-day on that subject, and with regard to the sorghum referred to of the older and coarser kind, it was said that it made grape sugar or glucose, as known to the chemists, and it could not be granulated. Now, we hear it stated here to-day (I knew it before) that there is a process of granulating, and that as good sugar is made, and that it sells in the Philadelphia market as well, as the sugar made on the Louisiana plantations. I think what we have heard to-day, and what stands upon that table, are hopeful omens in the line of improvement and advancement. And I would say, still further, that because some farmers denounce it is no sufficient reason why we should

abandon it. You never hear anything advanced in the way of improvement or change which some farmers do not denounce, and some of them have reason for doing so, because there have been so many impositions practiced upon them; I do not therefore, wonder at it so much. Still, when we look at the immense tariff which we pay on our imported sugars to protect less than nine per cent. of the sugar that is consumed in our country, which is raised on the plantations of Louisiana, if we can, as it seems we may, introduce this cane for the purpose of manufacturing sweets on our farms, which shall save us the expense of these high-priced sugars, let us give this matter our careful consideration, and do it. I have no doubt it will be a success. Prof. Collier is a very careful and thorough experimenter, and he is very confident of success. The instance referred to in New Jersey is not the only one where sugar has been manufactured. In Champaign county, Illinois, there is a factory where a large amount of this amber sugar cane is manufactured, and a correspondent of the "Country Gentleman" in that county speaks very highly of this enterprise. I hope, therefore, friends, that you will give it your careful attention and make a test of it.

Mr. Day. I want to inquire in regard to the amount of syrup that can be made from an acre, or any given quantity of ground?

Mr. Gold. In my neighborhood, sorghum has been grown for three years. The first year I accurately measured every rod of ground from which my neighbors delivered their sorghum to my mill, and kept an accurate account of the yield of it, and it varied from one hundred gallons of syrup per acre to something over three hundred gallons per acre.

Mr. Day. Never less than a hundred?

Mr. Gold. I think the first year no one raised less than a hundred. Last year there was a greater variation in the range of crops, and this year a still greater variation. Some crops came on very slowly indeed, and some were very remarkable in their yield. I did not get the measurements of ground this year, but only judged them from the appearance of the cane.

Mr. Day. Did you make any estimate of the actual cost of a gallon of syrup?

Mr. Gold. I made some estimates, but, like other new things, I made a great many false moves.

Mr. Wetherell. Will you state to us the general character of the soil on which you grow it?

Mr. Gold. They all grew it on common corn soils. It did better on the lighter quality of land than upon the heavier. But they didn't give it half a chance, most of them. It was ignorantly planted, it was ignorantly cultivated, it was half the time carelessly manufactured; but we made a good, pleasant article of table syrup, that was preferred on our table by a large number of those who had an opportunity to use it, to maple syrup, and we found it, as an article for making certain kinds of cake, and for sweetening fruits, a more desirable article than the molasses that we could buy.

Question. What is the method of boiling down?

Mr. Gold. We neutralize the acidity of the juice with lime, without any very fixed rules about it. Sometimes we did not get in enough, but we learned enough about it to know that there was a chance of doing a good deal better. We did not succeed in crystalizing any sugar.

The report referred to by Mr. Wetherell was not published, owing to some informality in its delivery, and was referred back again to the same committee. This committee, consisting of Profs. Johnson, Silliman, Goessman, and others, have made an exhaustive examination of the subject of the processes of Prof. Collier, and of the practical work at Rio Grande, N. J. I have seen this report. It is now in the Department of Agriculture at Washington. The claims of Prof. Collier that sugar can be made from sorghum and that with certainty, are triumphantly vindicated by the practical tests of the past season.

Mr. Bill. Can't you go to the market, and for the same, or a less amount of money, than it has cost you to raise it, purchase as good or a better article?

Mr. Gold. Well, sir, I am so far satisfied with the result

of my experiment, and I see so clearly the cause of the failures and the expense that we have been subjected to, that I propose to continue to try it. I am not going to give it up, by any means.

Mr. Bill. It seems to me I do not get an answer to my question. I would really like to have that question answered. The gentleman is intelligent enough to understand the question I put to him.

Mr. Gold. I do not know of any single crop that was raised by any man, stripped, and delivered at the mill, and manufactured, that we could not see places where there could have been a very great improvement, either in the method of culture, in the method of stripping, in the time of boiling, or in something else connected with it, that would have so far varied the actual pecuniary result that we are confident that it can be done at very much better rates than we were enabled to do it. Now, stripping by hand is a tedious process. I had not men and boys that I could devote to it, and I hired a man that I would not have hired under any other possible conditions to do it.

Mr. ——. You are liable to that with all sorts of crops.

Mr. Gold. Yes, sir, but sorghum was a crop which we did not calculate upon much; we had not made arrangements for it. I hired a man and paid him just twice as much as his work was worth; I knew it all the time.

Mr. Bill. What did it cost? I am afraid I am not going to get the cost of this article. I want to say a word here. Ten or fifteen years ago I went into it, head over heels, as I generally go into everything. I was sanguine there was money in it. I planted it over and over again; I believed heartily in it, and I finally came out with the loss of every dollar I had put into it. I have no idea of going into it again; I don't want to get burned a second time. I think there are other crops to which the soil of Connecticut is adapted that we can raise and make more money upon than we can by continuing in the sorghum business. At the same time, my friend is at liberty to pursue any kind of farming he pleases,

but I think the men who go into sorghum will come out of it with the loss of their time and money.

Mr. Yeomans. It would be a very difficult matter indeed, to make any of the sorghum growers in Columbia believe that it is not vastly more profitable for them to grow sorghum and have it manufactured, than to go to any store and purchase the syrup. In regard to the quantity raised to the acre, I regret very much that I have not at hand the figures that were given to me by Mr. Brown. I am very confident that some of them were much higher than any named by your Secretary; but still, those amounts vary very much with the season. For instance, the season just passed, the juice indicated a much lower degree of saccharine matter than is usual. Mr. Brown was unable to account for that. He had the impression, from the great heat in the latter part of the season, that the juice would contain more saccharine matter, but the test of the saccharometer proved it only to be about two-thirds of what it was the year before, and in some cases only one-half. So you see from the same quantity of cane this year there would not be over two-thirds or one-half what was produced last year.

Mr. Gold. Mr. Bill asks me more particularly for costs and receipts. In the case of my cane, I had a very heavy crop of seed. Now, what with the pressure of business, and our ignorance of the methods of handling it, and so on, we did not take any care of that seed at all, except to draw it home by the cart-body full and strew it in the barnyard, and let the poultry consume it, which they did; of course, we did not take that into account, but there were thirty bushels of good heavy seed, worth half a dollar a bushel for feed, that we did not take into account. Although we can not give the figures in dollars and cents of the cost of the crop and the returns, yet we are so far satisfied with the result that we propose to continue the experiment still further. Two farmers in Sharon, living twelve miles from me, raised little plots of sorghum this year; I don't know how many rods; they couldn't tell me; they said they only put in a little patch.

They drew that cane over the hills to my mill; one of them had some eighty gallons of syrup and the other had forty. They think they will never draw cane again that distance, and I don't believe they ought to; but they got a great deal more sorghum than they expected to from the amount of ground devoted to it, and were well satisfied with the yield of syrup and with its quality. Here was the expense of a transportation of twelve miles, that ought never to be attached to it, and in taking into account the cost of it, we must consider that it is a very heavy article, that must be manufactured close by where it is raised.

Mr. Olcott. What is the charge for grinding and boiling?

Mr. Gold. We charged thirty cents the first two years; this year we charged twenty-five cents a gallon.

Question. Do you recommend the amber variety?

Mr. Gold. Yes, sir.

Mr. Fulton. Mr. Gold has not covered the whole ground. I saw it stated in the "Connecticut Farmer" a while ago that the seed of which he speaks made equally as good flour as buckwheat, and was a good substitute for it. I know a gentleman in Gilead who grinds it with corn, and says that it makes excellent feed for cattle of any description. I have had mine ground this year, and I find that it makes one of the best feeds for my hens. I claim that the seed and leaves that I have fed to my cattle will pay me for all the trouble in raising it, outside of the twenty cents which I pay for grinding it and manufacturing it.

Mr. Gold. The sorghum plant is cultivated as a grain crop in many parts of the world, feeding more people than any one cereal, it is said, and it is considered that the grain crop alone ought, under proper culture, to pay for the cost of raising it.

Mr. Wetherell. It is said that it will by those who have tried it.

Mr. Olcott. I merely want to say one word about those sorghum crops that Mr. Gold mentioned as having been hauled over hills eight or ten miles, one of them producing forty

gallons of syrup and the other eighty gallons. Of course, it was a heavy tug, but it may save the small farmer forty or eighty trips to the store with the molasses jug. Think of forty or eighty trips with the molasses jug, with your wife standing waiting Saturday morning, and the children wanting their gingerbread!

Mr. Myrick. I would like to ask Secretary Gold's attention upon one point, and that is, in view of the so-called success in New Jersey and in Champaign County, Ill., where sugar and syrup have been manufactured by concerns that cost considerable money, would it not seem the way to make the thing pay is to manufacture on the co-operative principle; to have a company get the proper machinery, as they did out there, at a cost of a good many thousand dollars, where they can make it in good shape? Is not that the only way to make it profitable, except where the small farmer can boil it down and make syrup? Does Mr. Gold think it best for the small farmer to attempt to make sugar? Can he make sugar on his farm, or would he advise the co-operative principle?

Mr. Gold. Probably the manufacture of sugar will be best conducted in large establishments, and my judgment would be, that it is not best for the small farmer to try to make sugar on his own farm. Out in Minnesota, where the cane has been raised for several years, I understand a good many farmers do make sugar on their own farms. They do not do it with certainty, but they do it from time to time. Their casks of syrup all turn to sugar in their cellars. They don't know when it is going to be done, or how it is done exactly, but it is done repeatedly, and with a little more knowledge, they think it can be done every time.

Adjourned to Evening.

## EVENING SESSION.

The convention met at seven and a-half o'clock in the Second Congregational Church, Vice-President Barstow in the chair.

After a voluntary on the organ, the Rev. Mr. Forbes, the pastor of the church, said:

MR. PRESIDENT,—Allow me to say a word. It gives us a great deal of satisfaction to welcome this body of men to our church to-night. We would not, by gathering you in a church, make your occupation any more sombre, but we would, if we could, by our music and by song, do something to cheer the labor of your hands, and the labor of your brains as well, and having listened to the organ strains, I will now invite you to listen to a solo—"Consider the Lilies."

Mrs. MURLLESS, the leading soprano of the choir, then sang the familiar and popular sacred melody, "Consider the Lilies, How they Grow," to the evident gratification of the audience.

THE PRESIDENT. I have the pleasure of introducing to you as the lecturer this evening, Mr. J. B. Olcott, the well-known agricultural correspondent of the "Hartford Courant," who will now address you.

### HINTS TOWARD SMALL FARMING.

*Mr. Chairman, Ladies, and Gentlemen of the Board of Agriculture:*

I do not know how to begin my part of this evening's proceedings without a word of thanks, at least, for this very pleasant ending of our pleasant sessions. We have had the best meeting here that we have ever had anywhere, I think, in the State.

This paper was first hinted at by Secretary Gold. He was instigated thereto by the following letter from a mother who evidently does not know exactly what is going on with the soil around her, but sees something is the matter, and writes in her sorrowful wonder and perplexity, a sort of epistolary prayer for help.

——— ——— CONN., April 27, 1882.

MR. T. S. GOLD:

SIR: I was glad indeed to receive my Connecticut Agricultural Reports *via* —— express office, twenty-four hours ago. Have been

so busy poring over them and lending to my neighbors that I have rather delayed acknowledging their receipt.

A young neighbor just beginning the charge of his father's farm is very anxious for the ownership of three or four of your *latest* volumes—for the last published one at the very least. Can he be accommodated? If so, please send whatever you may have for him to our express office.

May I make a suggestion, or, rather, ask a favor? That is, when the agricultural savants make their next report, will they try to inspire such as we, who live on leachy—"thankless"—so called, soil? Could they not find a few shining examples of success on land located in some "Poverty Lane"? Examples of those who have succeeded, on small farms perhaps, by a little poultry-raising, bee-keeping, and the like, sticking to their legitimate business, and not giving up the contest by going into the shops, crying out that "farming don't pay!"

A neighbor who, I argue, don't appreciate his calling, has just come in with one borrowed volume. He says that the reports of "Farms and Farming" from Woodstock, Middlesex, and other counties, are all taken from "these big farms," telling what men with means have accomplished.

This friend's father, who lives next to us (a man over seventy, of thrifty, energetic habits, and his wife of the close, calculating sort), has always insisted that "no one about here can get rich farming." Yet he raised nine of his eleven children, and gave farms, as I have always understood it, to his two farmer sons, besides nicely educating his two daughters and also a third son, now a physician.

"Oh! Mr. ———'s children had some money left them," cries out one man in ———, who, because *he* failed to carry on his father's farm, claimed that farming is unprofitable.

The youngest son, whom I referred to as wishing reports from small farmers, just said to me: "Pa always said that he never could have got along but for going into the *wood* business."

In my opinion, he had unusual success; whereas the calculating, wise, and wifely wife of the most progressive farmer in our neighborhood begs him not to get so deep into that business and into *tobacco*, year after year. *She* can see the poultry and other farm leakages, in his vain attempts to shoulder too much. Nor would she speak but for the sake of their boys, whose young lives (but for their mother's efforts) would be one unbroken round of toil—grinding work.

Mr. Gold, I would not write so at length, but I have lived in Connecticut over twenty-two years only to see our choice young men driven off to become ciphers in the city, or, finally, to lose their health for working in the *heated* shops. The few who stay tread in the old ruts of hard, grinding toil. The sons of the noble mother just referred to never will follow the example of others—groaning and growling over their poverty; "too poor" for a little

village enterprise; "can't afford" to take any *other* paper than the *Courant*, and all that. Still, it is so hard to see them grow old before their time. A relative of their father's, a farmer from ———, says to him: "You might have been a rich man if you had spent the manure you have done on any other land than this."

Now, are there not instances of successful farming with small means on just such land as this? Cannot Mr. J. B. Olcott or others bring them forth for the inspiration of our young people?

As for *my* only son—*p'rhaps* it is as well that his father (who was a clergyman) died "intestate," and that, through Rev. —— ——'s interest, he is starting a sheep-ranch for a Boston man in Southwest Missouri. His exile comes hard upon his mother and sister, but he bears it bravely, as so many others have done before.

That you may never grow weary in all your well-doing for Connecticut *homes* and farming is the wish of one among the many benefited through your instrumentality.

Respectfully yours,

Mrs. ——— ———.

I did not see this letter until my piece was done, but I know the burden of it by many instances, and could scarcely have changed my course of thought had I seen it. Successes of any kind are like wild pigeons in not always lighting on the same tree. Samples of success in small farming—even on sandy land, are as plenty as healthy broods of chickens. But if the chicks are lousy, and hawks and skunks abound, we must clear out the vermin before we can expect thrift. First pure, then peaceable. To have small farming earnest and strong in Connecticut, Society, the ignorant Pharaoh and task-master of these times, must see the need for its own welfare, of letting the people go at it. The old preachers were not out of the way when they urged a change of heart for righteousness' sake.

This very interesting letter gives a hint of the enormous mass of materials awaiting investigation by the people in every neighborhood before we can have social science or a saving common sense for the farm. Each word of this sincere, womanly epistle is suggestive. We get in it a glimpse of every rural community in the commonwealth. The most hopeful reflection about it is that where one woman has got ready to write her troubles to the State authorities, thousands must be thinking about them as they never thought before.

The matter of small farming before us is a grave social subject, older than history and coeval with trade or barter. We need to know how society grows as well as how crops grow. Being

a successful small farmer does not imply the ability to speak intelligently for the myriads of small farmers who have failed all over the world, or even for the failures in our own nation, State or town. The fat gosling is a cheerful fact which we all recognize, but we do not expect the fattest one to give a theory or philosophy of our lean poultry. The old orders were to bring in tramps from the highway to our feasts of reason and flowages of soul, and I would as lief show failures as successes in my attempts to mark the channel of progress in small farming.

One evening gives us little time for anything but the briefest hints and suggestions concerning the "luck and chance" that surround us in the broad ocean of daily life.

The unwritten pedigree of the peasant farmer is as long as that of the prince, and may be longer unless the family of the latter goes back to the cooling affairs of the ground to rest and vegetate, when their heads begin to ache with the cares of State.

Farmers understand the order of growth in corn or grass; how the seed, with and without man's intervention, falls to the ground and continually flourishes in lasting life. But they are rather slow to see how development works upon civilized man by a sort of banyan arrangement. That noted sample of Asiatic vegetable wisdom shoots upward from the ground with a noble impulse, but the lofty tree appears to know, by a sort of botanic instinct, when the wind blows too hard, when the air becomes too thin, when every thing becomes "*too* too." altogether, for its health, in those extreme altitudes, and turns humbly towards the earth again.

We have numerous plants of our own which illustrate this saving law of nature. The squash-vine can be stimulated by an artificial environment of forcing culture into an extraordinary and wasteful growth. So can the strawberry. But wise gardeners have sharp remedies for over-luxuriance. When neither drought nor frost nor blight intervene to stop it they nip the sap of roots or tops and bury buds and joints in the soil.

We who are not blind to the fact that over-refined people may become "too utterly utter" in their minds and bodies for any earthly use, will be devoutly thankful when some fortunate chance packs the homesick family comfortably off to grass in the country. We owe the best civilization of New England to that saving banyan instinct in highly cultivated races, which transplants itself from the crowd to find room to grow.

Mr. Oscar Wilde, whom we are inclined to laugh at, was a sort of disguised apostle of this doctrine of lasting life. He found difficulties about engrafting a healthy bloom of art upon attenuated social sap in America. No doubt he will teach his best lesson by proceeding to invest the cash we paid him in some choice bit of homely landscape according to the latest æsthetic, small farming fashion.

All of us were once farmers in some period of our development, unless it may be that we are not yet up to that condition, or have, in scriptural language, climbed up some other way.

In this view, Mr. Chairman, the plane of small farming development lies between all other human strata and those curious and always instructive native growths which we too often contemptuously pass as belonging to savage life.

Some critic may wish me to split off another layer in this division betwixt the wilderness and the farm; that, namely, of hunting, fishing, and the herding of semi-domestic animals. I will do that if you please, or anything else to be agreeable here, but we find it difficult to do so. If there is anything to hunt or fish for in New England, we still hunt and fish with all the ardor of the wildest man; and if our lives have become sensibly artificial, we return to the wilderness for a while in midsummer, with even more positive pleasure than the born savage enjoys. As for sheep-ranging and cattle-herding, those are quite modern ideas, blooming fully to-day upon the public domain at the west in splendid competition with their restricted development in the east, wherever our rural villagers and small farmers allow animals to run in the streets.

Whenever, for the purposes of a talk, any fellow tries to handle mankind in convenient classes, don't let us be touchy and bother him too much with nice distinctions. The task is hard enough any way. Human development is so wonderfully various, and individuals are such strange, composite creatures, that it is almost impossible to class them. They fly around so that they are as hard to count and arrange in scientific order as the "speckled pig" in the litter. The peasant farm boy of to-day becomes the president of a great nation to-morrow, and they say our latest elected governor and president of this board began public life as a newsboy.

For practical farm purposes it makes no difference whether our

"grade" children derive their farm breeding from their paternal or maternal parent. The only certainty is, that where the life, culture, and training of parents and forefathers has been so various, the exact direction children will take is a conundrum which no fellow can find out. The greatest comfort in this connection, where the chances of fortune are so odd and unforeseen, is that the versatile ability to light always upon our feet, when we fall or jump, is a precious inheritance.

In clearing the way for what we shall have to say, farther along, it may be well to touch upon the painful wonder, existing in the minds of many, that children should leave the farm and garden for any other employment. There are natural reasons why this should be so and there are plenty of artificial reasons. Our misfortunes, our laws and customs, our education, and religious teachings—springing shapely or more or less distorted from nature—push the callow young birds from the farm nest even when they have the greatest inclination to stay there until their wings are grown. The top of a social plant makes inexorable draft upon the roots in a dry time, unless we manage to control development by timely mowing or pasturage. Besides artificial promptings out of agriculture, there are inevitable natural inclinations to dig out. This tendency is as old as Adam or the first woodchuck. We want the farming family able continually to bloom for market, and grow good boys and girls for market. Agriculture must have its qualified agents scattered abroad in the land. When our social scum or cream grows bitter, we want some one standing by who can tell what is the matter with the cows or grass or land or people.

In the days of our childhood we were frequently called to grieve by the good preachers of that time, because our first parents, all nicely fixed in the garden, broke up their business and quit. Being any way related to us how could they help it? They hadn't a common grocery, nor hotel, railway station, telegraph, telephone, newspaper, or post-office, within a mile and a half! There wasn't any market, near or far, that we read of, for what surplus apples or figs they might raise. There was, it is true, a sort of pomological lecturer in Eden, and I think the devil has had a hand in fermenting our grapes and budding our rotten orchards ever since. But father Adam had no auctions, nor agricultural horse-trots, and mother Eve no chance to get "pinned paper patterns

from Paris," of the latest arrangement in fig-leaves by mail; so what was the use of running a garden? Any young couple of these days—no matter how bred or educated—would have been as discontented in such a paradise as we are in our own surroundings.

Hereabouts we may take a hint, if we please, for the location of our new gardens. Production drags unless consumers are handy for every crop. We need not dig so far west and south. The newest as well as the oldest inspiration and gospel for small farmers teaches them to bait consumption close by home. That old paradise was too isolated, and while the country is strung now with wires, like spider-webs, from station to station, in railway lines, rural postal service and communication between Connecticut farms and the consumers of farm produce in Connecticut are relatively slower, compared with the new facilities, than they were one hundred years ago. Small merchants may be interested to know that our young women can trade through the mail with New York, Philadelphia, and Boston, to better advantage than in the village store, unless the latter can handle local farm goods.

Except as a warning I should say that our aged teachers were wrong, and that we have no occasion to cry for that old spilled milk. But the fact is, while it is easy, in these days of rapid transit, to quit the garden or farm in our youth and strength, and we are continually doing that to-day, it is not so easy keeping away. Wherever we go we find the everlasting ground, with its everlasting questions of right and wrong for the farm and garden staring us in the face. We may fly the farm nest and flap our wings gaily for awhile, but we can't fly the globe—we fall nearer and nearer to it and finally touch the earth again, dust to dust, at last.

Pray heaven that we light on our feet and do not strike too hard; that we do not alight in such a frigid wilderness as our Puritan forefathers did,—with the soil they had in its virgin wealth, reduced to a desert—and that some remnant of fitness may remain in our minds and muscles for the wholesome and strengthening occupations of the farm.

Some of my friends mourn for the good old times, when our young ones couldn't fly so far, when all they could do was to go up or down the road a piece, and build, and tend sheep, or poultry, and be happy and rich by their own simple industries. Don't

you know the railway has changed all that—not forever, but for a while—until the people, like water that has broken its former bounds, find their new level. Let us wait a little and work. Just now some fellow out west, on a railway, has a lot of frozen mutton, poultry, and preserved eggs, bought cheap to spoil our markets. Presently his first costs will be dearer, his freights more, and his home market better. Meanwhile, we must learn his trade better than he knows it—we who are young and strong.

This is the position, then, we are in and must maintain. We have a natural right to leave the farm and garden when we get too uneasy, ignorant, and unfit to remain there, tempered by the probability that we must yield, in ourselves or in our progeny, to the quite as natural inclination to return. Life is constant motion, remember, and new motions spring even from death.

But some one asks why we should have small farmers and small farming at all? Why small farmers any more than small potatoes, in these extra scientific days? Here we go into a batch of questions as old as private theft and public robbery. I do not intend knocking down your judgment with any twitting of facts that I can avoid in this paper, but science or no science, the smartest of us have grown some small potatoes in our time, and the biggest farmer among us will speak with the greatest pride of younger days, when he was a small one.

I never heard any potato-grower complain, though, of a reasonable share of small tubers. Some prefer a medium or egg size, with well-developed eyes for seed. Some say it is better for a large farmer to begin rather small. I like such seed and such beginnings myself.

But when, from drouth, or poverty, or any other cause, we find our potatoes and farmers growing smaller and poorer every year, and less capable of propagating virile and productive crops in the following seasons, then the decrease is a proper subject for inquiry.

Is it not becoming manifest to everybody that the standard of manhood and womanhood has been lowered at a fearful rate among us during very recent years?

The clothing of the modern Procrustean bed—the sheets, blankets, and comforters in market—are made so short now as to freeze off anybody who sticks out over about five feet.

An idea of abolishing trial by jury is being seriously discussed, because of the difficulty of finding a dozen sufficient jurors,

who can afford to leave their business to fill a panel. For many cases of the first importance, a jury of twelve has been done away with in practice already, and one of six or three substituted. It is easier, of course, to find three or six honest, intelligent, and just men than it is to find twelve of them, and the lesser number is more easily managed for dishonest purposes also. Possibly we are growing reluctant to expose any more innocent people than is absolutely necessary to the contaminating air of courts, made and provided.

The trouble with jury trials, by the way, comes not only from a scarcity of good stock, but from the selfish machinery by which the jury may be chosen. The essence of a righteous jury system consists in putting twelve upright men, twelve green fisher-apostles with one traitor only, if you please, into the council of case-hardened lawyers and judges. A jury should never be chosen from an impecunious pack of court rats and hangers-on. We want naturally shrewd, independent men, such as formerly grew up on small farms, and not men specially conversant with the tricks of courts. We would not select our wives in Utah for the sake of having them much acquainted with matrimony.

Complaint of juries, in the conflict between right and legality, comes largely from the side of those who sympathize more with corporate life than with family life. Corporate industry, as it has been wickedly managed in this country, is the reckless destroyer, instead of the supplement, of family industry. To say what can be destroyed ought to be destroyed, and that better things for the family may grow out of corporate endeavor are the principal arguments in its favor. It is scarcely needful for me to hint that unjust laws and judgments are fit to burn all small farming instincts from the popular heart.

Our Puritan forefathers ran away from bad laws quite as much as they did from bad religions.

Must I remind you of other unpleasant things to prove that our population is or has very lately been deteriorating in quality? How often do you—competent managers—set two, three, four, or five men to do one man's work, and then have to go and do it over again yourself, or let the labor pass without being rightly done?

How many of us prepared the ground for some crop this year and other years so unskillfully as to fail of gathering any harvest to speak of?

Why is it that our railways are broken down with their freight of provisions and supplies for winter, and were just now valuing brakemen and ignorant farm hands at ninety cents a day?

What is the reason delightful top-buggies, phaetons, and all manner of gay vehicles and harness for pleasure and pride increase on our miserable roads, while small farmers declare they can't afford a horse-cart, but must do all their business, shovelling in and shovelling out, of a long, cumbrous lumber wagon?

What is the matter with Hannah and William, that they and so many other young people are not happy in marriage now-a-days, and bother our courts with suits for divorce?

Whose wasted manure is it that makes so much strange sickness, sapping the vitality and undermining the strength of many families? Men have extra pockets now for medicine. Lovely women remind one another of their matutinal bitters—"*Have you took your pill this mornin', Maria?*" and they elevate their noses on the street with the jauntiest air for their infinitesimal powders, rejecting the less etherial tonics of our buxom grandmothers in the onion, turnip, and cabbage.

I expect daily—such is the "progress" of modern "refinement" and "genteel" reform—to hear of some great plant of capital and machinery to purify and spiritualize all our ordinary garden sauce against "the materializing tendencies of the age." It will be a "whiskey-still" under another name. The quinine habit—another old man of the sea—is already loaded upon the shoulders of an army of staggering Sinbads.

We have, and always may have, large classes, more or less effete, able to pay for the refinements which soothe and shorten their lives.

How much the small farmer should work for this blood-money is a question for his conscience. Who takes the sword is mighty apt to perish by the sword. The production of better fruits, vegetables, and grains in plenty, with a better common sense as to their use in untarnished freshness, would be the strongest preventive of our diseased craving for refinements.

How is it that our list of paupers, the insane and vicious, increases as we increase in unequally divided wealth, so that we who are rich don't know whether we should be worth a cent or not, after all our debts and bills of damages to society are settled? Having abolished human slavery, property in man, as we flatter

ourselves, and set so much more ignorant capital at liberty to invest itself, we ask with Cain, when anything unpleasant occurs, "Am I my brother's keeper?"

I do not put these questions expecting to answer them here, or that you will answer them in particular. I ask them because I think they are hints towards small farming.

In asking these questions, I do not imply that the farming class is especially responsible for all the troubles indicated therein. The evils hinted at are social evils which every one suffers, and for which the leading class in the time that brings them about is especially guilty.

So far as farmers propose to lead in the social progress that is to come, so far they must tighten their waistbands for a manful struggle with the difficulties of the day, however they have come. These questions are fit questions for an agricultural convention, and they are as fit for a political caucus, a polite tea-party, the common talk of the street, corner grocery, shop, or factory, and the more serious discussions of the church horse-shed, the family circle, and the earnest communion of the human soul between itself and its nearest and most available good.

But all our discussions will amount to nothing, or worse than nothing, unless we do something. There was a power of talk, though, just before the building of Babel was stopped.

You will perceive how I am all the time hinting that, however much we may admire big things, we must continually plant and wait for them to grow out of small ones. Our children must begin with their alphabet and baby shoes, as we did. They must have their small ships, or boats, and little mills under the hill, and small farms also, as we had. Your mammoth arks of safety— your "Great Easterns," require too many small farms submerged to float them.

Hundreds of Americans go every year to gape at the pyramids. Too few of them, I am afraid, consider the immense force of leeks and onions combined in their building, as too few of them remember how many small farms in America must be pinched of fertility and power that one single person may indulge in wonder over the deserted relics of decayed peoples who forgot their roots in the small details of agriculture. Still, we must not begrudge this outlay in the interest of small farming. We live on a tight little planet, swinging through infinite space. Our discontented lead-

ers always—like bell-wether sheep in a new pasture—will be continually pushing their noses into all sorts of unlikely places while trying to get out of it. But the common people are beginning to see—some think they always have seen—in a speechless way, how "the kingdom of heaven is at hand."

Where so much neglected land as there is in our country lies begging a better owner, the proper size of a farm depends chiefly upon the locality and the strength and method of its management. A poor pasture stingily managed and poverty-stricken often seems too small to the owner, while he might be far richer with the price of one half sold to a good neighbor and spread in manure upon the half retained. To sell the half of one's land to a bad neighbor might leave the remainder, under the new and unpleasant conditions, far too large for comfort.

If we live by skinning land in "cultivation," so called, then we should be glad of a fresh field for the plow every year; or if we skin a large part to intensify the production of a smaller part, we may wish, if we have strength to skin much, to double our acreage for skinning, in order to increase the acres under intense culture.

Where skillful gardening enters, and land is dear while manure is cheap, there the profit lies in *deep* acres—acres that are four times as good because they are only one-quarter as thin as they were before, and are now capable of two or three crops a year, where skill—one form of strength—is plenty and the market is hungry for produce.

It is a hint for us who are not farmers and still wish well towards agriculture, that farmers are not as generous as they used to be. They have little to contribute for benevolent purposes. Some pretend to think they are not as honest as they used to be. They can't pay their debts, and the village dealer declares "their trade don't amount to shucks."

This is a true bill in some places. The farmer don't give, may be, because the beggarly land around him exhausts all his power of giving. The intense farmer suffers intensely with the mute poverty of his soil. Don't mistrust his honesty if he deals honestly with that, for there, in the ground, is where honesty and dishonesty begins. We have raked together some shining cities and villages in Connecticut during 200 years of occupation, and their poverty-stricken surroundings show very often where the concentrated wealth came from. Not all the dishonesty of this abstrac-

tion lies at the door of the farmer, neither is all the suffering and punishment his.

We can't disgorge our plunder, nor repair the damages in many a year; but we can at once repent our rural sins, recall the dogs of civil war, and begin a social understanding that shall include the whole commonwealth and all its people.

The proper size of a farm depends largely also upon natural divisions. I know of spots—remnants and odd corners of three, five, or six acres, or more of land—bordering streams, woodland, ravines, the rocky spurs of a hill or mountain, that could be fitted into as perfect farms in their way as if they contained hundreds or thousands of acres. We may do more for profit and beauty with half an acre than we often see done. We may have small farms for four horses or oxen, and quite as admirable and respectable small farms where a donkey and cart is team enough.

Farms are well cut out in our broken country, as carcasses of meat are by expert hands, in whatever direction the bones run, or judiciously across, so as to give each piece a streak of fat and a streak of lean, as well as a share of the choicer and tenderer parts. Over-reaching and managing chaps are always on the look-out for good bits of land—hams, so to speak, or clear pork—so that the patient and faithful have to wait a long while sometimes for the over-reaching grip to relax in the natural order of things. Others are smart enough to get a sly law on the statute books under the ruling of which to cover some coveted territory. We continually see much good landed property injured and wasted or in idleness, caused by uneconomic divisions. In this respect the extensive farmer who has spent a long and laborious life in extinguishing many small and conflicting titles, though he has become what we call "land-poor," or possibly "a speculator," may yet be counted an excellent servant of society in providing a fair field for better divisions.

In this direction, whenever a considerable portion of territory can be controlled in one body, there is a suitable and profitable opportunity for skilled and beneficent capital. There something worthy the name of agricultural enterprise can be carried on to success without involving the capitalist in "fancy" or extensive farming and the acquisition of a landed estate with overgrown buildings which perchance may hang like a millstone around the unwilling necks of his half-bred children. Our western brethren

are not slow to see similar openings in the flat prairie country, but so far as I know there has been no special effort to establish cosy farm settlements or divide unoccupied land in this state into small and pleasant holdings for beginners, or those of little means and not too ambitious desires, who may wish to return comfortably to the soil again.

This artificial swarming is often enough done in cities by too hasty and feverish spells, and I see no reason why it cannot as well be done soberly and methodically in the country, wherever the requisite means and skill are at hand.

In another New England State I once knew a doughty farmer who made it his especial business to buy and improve small places that had been mismanaged and run down. He was a tremendous worker, and liked nothing better than to right up, underpin or move and reorganize old or badly arranged buildings. He was a great artist in restoring neglected fields, meadows, orchards, and gardens. He did just enough, but not too much, and could never live upon the improved property long before some purchaser would be glad to pay him a profit upon his labor and give him the means and time to move to the next inviting spot for his truly heroic exploits.

No one knows who has never tried it what weary, losing, trying years occur, wearing away life and hope, where inexperienced families, even with sufficient means to begin with, try to do all these things for themselves. The lack of helpfulness in this respect is one of the great mistakes of our time. Capital, instead of helping agricultural settlements in the east, probably does much by its coolness and indifference, or preoccupation, to drive out many people who would be far happier here, among accustomed scenes and associates, assisting in restoring our waste places. These are people, too, that the commonwealth can ill afford to lose.

Sometimes a sort of wrecking spirit prevails, and unaccustomed or enthusiastic people are induced by false lights to withdraw their savings from banks and expend them at great disadvantage, waste, and perhaps ruin, in the country, to the scandal of society and the ultimate loss of all concerned.

Periods will continually occur, however, when the popular mind is turned towards rural pursuits, and there is a demand for well-ordered and comfortable small estates. This demand is legitimate

and should be met beforehand, as any other cash market is, by well-planned and well-executed divisions of neglected farms into snug and salable properties. Some of our old farm buildings are scarcely habitable by decent people, and only fit to harbor questionable characters who may be expected to grow worse rather than better under depressing and hopeless conditions.

We should hate to see small farm industries worse ordered and less thriving than the industries of prisons, jails, and reform schools.

Strange crimes and horrid reversions of humanity occur in connection with agricultural neglect. Motives of policy, saying nothing of any higher reasons, must soon induce us to turn a portion of our reforming energies into the dark and sometime forgotten corners of Connecticut civilization.

As it is in the town, so it is in the country—the worst conditions may exist in close proximity to such as are called the best.

The French got mad once or twice and destroyed or tried to destroy about every institution they had, causing infinite loss and misery to society, and warning the middle and lower classes, so called, all over the world to beware of lofty superstructures.

It is said that land-holdings in France have been divided to the extremist possible limit, and complaints are now frequent that plots are too small.

Great Britain has long been busy in a slower way with the same class of questions. The British people, or British colonies and commerce, have had to pay dearly for the civil war between British "cotton" lords and landlords. We catch all the fevers and rages that have a run abroad, and think of our abandoned land now as never before. We can only save ourselves from wasteful and bloody revolutions by constantly making, with a higher intelligence and a tenderer conscience, the small but needful changes which prevent revolutions. Frequent fit changes of policy are as easy and restful as turning over in bed, so long as all hands understand and approve them.

While we have been skinning the West and South with all the means we could scare up at home or import from the old world, New England is growing up to woods. As we approach the end of those wholesale depleting operations and begin to pick up our agricultural crumbs in the East, we find the old lay-outs of land and roads in many places unfit to match a new order of things or

to nourish the new centres of business. We find ourselves with plenty of money in hands that are not experienced in managing land. So we have to move cautiously and slowly.

Statesmen of the near future must concern themselves more with the course and condition of common roads. This beautiful city of Rockville has probably been favored this fall with a freight of fifty cents a bushel on potatoes from distant Dakota. And your enterprising and provident dealers and speculators have learned something of our common roads of late in their exciting hunts after lost freights, delayed and freezing on the track.

A railway line cannot always insure the whole people against scarcity any more than the great post-diluvian tower which busily employed ancient engineers and capital could insure the whole people against another flood.

The railway has answered well for butchering land in America, and building noisy, wasteful cities quickly, but it remains to be seen, after the next railway panic, what share an iron road with a wooden foundation may have in our future civilization. It may be an image of brass with feet of clay. For a machine which must have a perishable timber foundation, the locomotive too often carries an incendiary torch among our forests.

In the case between common roads and railways—a nation runs surest and safest that learns to. creep and walk first. Eminent and far-seeing railway engineers admit the ghastly look of iron roads through an old and deserted country with no convenient common roads. The people see that railways help them as chartered turnpikes once helped them, and that the latter had their tyrannical day and generation. An over-bearing railway system hurts us as all systems do when they grow unwieldy and unmanageable. Slavery at the South was not so bad a system of labor until it grew so mighty as to threaten or prevent all natural and kindly development of master or man. We don't want our natural leaders or followers consumed and destroyed by running some superhuman Juggernaut. Our railways and all our institutions are experimental creatures of statute law. When they become oppressive of small industrial growths, it is idle to say they will be destroyed, for they kill the popular strength which supports them. If the development of farming and gardening near by is continually punished by the introduction of far-fetched produce because it is cheaper, then by the same rule of might, whenever an

indignant rural people sees its power, manufactured wares will be allowed to come in free because they are supposed to be cheaper.

My good German helper tells me that in his country, where thrifty and intelligent small farmers are judged necessary for the foundations of a state, that every farm cottager keeps a few sheep. These sheep are recognized as property that must be protected as a convenient source of mutton, leather, wool, etc., for local use and possible sausage-skins and fiddle-strings for exportation to America. The sheep are combined in one flock by those methodic German peasants, watched in the commune (common) field by a trusty shepherd, regularly appointed for that branch of the civil service, and folded so many nights in the year with each owner, according to his number of sheep, to divide the manure fairly.

In this way the common people continue to receive object-lessons from this small and useful domestic animal. Children and dogs grow up to respect it as a regular source of broth and bones. Grandmothers knit the tag locks into socks and mittens, and all hands so learn the taste of tender, juicy meat, that is not dogged or sickened alive between the stinking decks of a railway car, that when picked peasant boys grow up, by any Cinderella chance, to take a trick at the wheels of state—so to speak—they retain a few bowels of compassion for the shepherd-peasants and their flocks, and see that they are let alone, at least until some royal war or wedding time for shearing.

Now it is evident, without my illustration, that a monarchy can be built in the gravy of juicy local mutton, but have we sufficient hope of our ability to nourish young republican statesmen, generous or just to agriculture, on the tough fiber of sheep far-fetched by feverish railway transit? The stringy, jerked meat may be twisted in barbarous railway schools into swinging lashes for slaves, but the line about "Mary" having "a little lamb," and the poetry about the patient animal as a sacrifice, must grow out of our literature, secular and religious, while we give the revenues of the state over to an army of railway farmers who only know the sheep as a railway product.

Some may think it naughty to criticise our railways. It is getting to be about as hard to run a railway as it is to run a farm. Whom goodness loves goodness chastises. We love the railway too well to stand calmly by and see it driven astray.

Only by the aid of railway power applied according to just laws

for every one of us can we ever realize the hope of poets and philosophers in all ages, of making the whole world a garden.

But for our swifter communication of ideas and the new hopes growing out of the new conditions, American civilizations must hem themselves in walled cities, as so many older civilizations have done before, and wear themselves out—with the vigor of human races and the fertility of soils—by fighting, like the cats of Kilkenny, as so many purse-proud cities have done before.

Our modern doctrine of "the greatest good for the greatest number" is a fraud, anyhow, and made to become, in the hands of oppressive managers, the most damnable tyranny over the scattered and defenceless few. It is the essence of the rankest cannibalism, which eats the helpless outright. It was that doctrine, in the washed hands of legality and an organized mob, which crucified Jesus. He tried to teach us the eternal regard of goodness for the falling sparrow, and the least of our fellows.

Some may think it absurd that I should propose a new lay-out for abandoned farms—grown up to brush and stuffed with rocks, like plums in a pudding—in fields, gardens, and orchards, while we are getting almost everything we need to eat so convenient and without trouble—except to pay for the goods—from an enchanting distance by railway. While fat land without a bush or stone can be had only two or three thousand miles off for the asking.

It looks reasonable—don't it—that every smart railway town in the east should jump its land values a thousand miles away over all the intervening country nearer the ring of its preferred streets, and the circle of its sewer-polluted air and water?

The idea may seem perfectly ridiculous to a trader or speculator inside the last railway combination, that we should try making attractive small farms and pleasant homes in any of the recent wildernesses of Connecticut. The deserted Yankee farm-house that we see may look and actually be more uninviting than the new and sweet western dug-out that we don't see. Besides, our land is often so very poor that we have to scrape our dishes and lay by our scraps for the pigs and chickens, or dig our malaria-making material into the soil to get a crop. The plumbers may earn their money, Mr. Chairman, but they cannot bring us salvation from that trouble. The science of the farmer's sons who build our cities and villages seems little better, as yet, than the instinct of

the master fowls upon the roost, who perch as high as they can get above their fellows.

We who live in the country are bound by the desire of mutual safety to study the devices and fashions of city life.

The relations between city and country are as intimate as those of. the Siamese twins. It is an unsound head which draws all the blood from the extremities, and small farmers need to watch the centers of their political body to prevent what the doctors call "fatty degeneration of the heart."

In spite of precautions to the contrary, city drainage joins the inside of each house to every vile and wasteful deposit within corporation limits. This is danger enough, but later contrivances, ingeniously calculated to ease the purse as well as the mind, furnish upward pipe vents, so that the air surrounding each house must be contaminated with the gaseous emanations and the living germs of disease engendered by acres of festering sewer-filth.

This sequestration of fertility to diseased conditions is the law of every railway town on the continent, and I need scarcely say that it tends rather to the production of sewer-rats than of intelligent small farmers. There is small comfort in finding that farm drainage is no better.

O yes!—I know how the idea of any thoughtful, frugal, energetic, and finally profitable agricultural industry in the east must seem utterly foolish in some "practical" minds compared with the slaughter and destruction of western fertility by railway. One might as well discourse the joys of matrimony and family life to a drunken army during the sack of a city.

I don't expect to say anything that will check our western exploits much. Eastern harlotry demands the defloration of the virgin west. But I do hope to remind some few faithful ones that depleting agriculture must come to an end soon, and that it is high time we in the east began to do something better close by home. While we are enjoying the surplus fresh meat immediately after butchering, we ought to smoke some, dry some, and salt some, or swap a quarter or a junk here and there with a frugal neighbor, against the day when fresh meat is not so plenty.

Our population doubles every twenty-five years. At that rate of increase we shall number eight hundred millions at the end of our second century of national life.

At one of your local fairs here, I remember seeing the finest

string of peanuts, native to Tolland county soil, that I ever saw anywhere. Where such millennial peanuts are possible the best fruit of the best civilization is forever possible.

Local peanuts will need a little common-sense protection and a little of the fostering care that we read about. We musn't laugh at the small peanut farmer who begins in Connecticut with a broad-tired hand-cart, nor ridicule the home-like hovels which spring in the woods along side of our railways.

No check of railway farming can be easy while there is a rood of government land left to appropriate for extra "scientific" or "educational" purposes, unless we give our railway building army something to do at home. We paid the heart's blood of Connecticut for every dollar we made by slave labor, and we have yet to educate ourselves in scientific agriculture by helping the blacks and whites of the south to restore their ruined plantations.

These railway engineers, contractors, and builders must be taught to see the immense spaces of country, north and south, they have overrun and swept of timber, game, and all the charm and wealth of a virgin soil. The railway light, streaming through deserted farms and plantations—like the old-fashioned tallow-candle—only serves to make the outer darkness more visible. If we are to worship and admire the railway in the near future as we have in the near past, the happy children of railway civilization must soon be growing up in our second-growth wilderness to call it blessed.

Before our land can be properly laid out in small farms we need a survey of the State in the interest of boundaries—common roads, as well as railways. Possible new lines in accordance with the natural shape of the country must be made public so that every citizen may know what is proper to do, and in what directions roads should be made to open the country for settlement and the convenience of trade and travel. Farm land needs cutting with the same economy that village land does. But how many of our land-owners know or have ever thought exactly how their land should be divided to meet the necessities of the future?

Only a short time since I was at work upon a village street with houses on both sides of the way, and yet no resident knew exactly where the lines of the street were.

We are too careless of these matters. Some of us know as much of the surface of the moon, for any practical, engineering

purpose, as we know of the ranges of hills and valleys in our own State. We think more of the transit of Venus, a shadow, a speck, moving across the face of the sun—than of the transit of farm produce to the nearest city or village—or the transport of city waste back to the land again.

Much of the opposition to new lines of travel by rail or common road comes from those who have not given, and perhaps have had no opportunity to give the natural and feasible direction of our roads a thought. Impassable roads, or roads at a difficult grade, kill small farming and drive young people to emigrate before they are old enough to know what is the matter.

Possibly, in respect to railways, and common roads too, it may be for the selfish interest of a few to keep the many in ignorance until things are fixed so that the profits of a change may be controlled by a few. It seems as hard to-day as it ever was to get Ananias and Saphira, his wife, to take their equal share in the community.

However that may be, these public interests should be so illustrated and illuminated by a just government that all may see and become competent to take an intelligent part in developing our natural advantages. No matter if it takes a hundred years to realize our plans, so long as we work on the right line and enjoy the reasonable hope of making a good thing in the end for every body.

This Board of Agriculture would honor itself and serve the State well, by urging better rural engineering upon public attention at every opportunity.

Rockville might have that wonderfully beautiful thing—when you come to think of it—a continuous intervale road, down the Hockanum valley to Hartford. It can be made one of the handsomest drives in the world.

A bird's-eye view of our hills and valleys from a topographic survey would show exactly how our roads should run.

Our western brethren do not neglect these things as we do, but I am thankful we have so few flat surfaces of great extent, where the checker-board pattern—fatal to all pleasant surprises for the traveler—is possible. Occasional square 4-corners are nice, but a thousand miles of them are tedious beyond expression.

Our government will act in this matter when the people demand action, and not before. A government is a curious thing. Officials

are like hired men. Unless we provide them with employment to our advantage they will naturally enough begin to think, if they are any way smart, how they can fix things for their own. Unless we make money out of our public servants they will try to make money out of us. They will survey the State—not in our interest but in theirs. Selfish, private rings originate when the people fail continually to ring in public business louder.

Possibly some may think towns grow into villages, and villages grow into cities by chance. Not at all—it is always a certainty. Some strong man sees the great natural advantage in the first place. Other strong men see and help themselves with him, and others, floating about, undecided, join the concentrating current and help them.

So the man who would plant his family on a small farm must see natural advantages there, adapted to the needs of his time, and go to work, trusting in the eternal spirit of goodness, which always inclines towards a natural advantage. I think there must have been a living spring only needing to be uncapped in the rock which Moses smote. I hate to see a small farmer in this wealthy State picking a rock or caving sand that he must know, if he will stop and think a minute, will never repay his labor.

Far worse for small farming than working rocky or sandy land, is looking for what the boys call a "soft" thing. There is too much competition in that direction. Any good thing well done pays big in the neglected spaces of a rich community. Better look for a difficult thing, if it is worthy, because difficulty is its own advertisement, patent, and protective tariff.

A small farmer may succeed all the better among big ones—if he attends to his natural advantages—as the little republic of Switzerland thrives in the shadow of mighty and belligerent empires. Where many are dependent, humble independence shows the better by contrast.

We must admire, in passing, how that little knot of mountain valleys furnished for many years trusty, fighting guards for half Europe. Weak and corrupt courts were glad to hire and quiet Swiss industry was willing to let the surplus fighting element go away and learn its trade at other folk's expense. On a small farm the fighting quality needs to exist in a rather dormant state, bred and trained to peaceful exercises. There are vermin and weeds to subdue at home and abroad, and we shall see if we will see that

chiefly in small industries, which employ the mothers as well as the fathers of men in taking natural advantages and conquering natural difficulties, are the elements engendered for all really great organizations of force.

Since it is found that the earth no longer "laughs a harvest"—not a snicker or giggle worth a cent—unless we apply the straw we tickle it with just so, the idea is becoming fairly current that brains are required to succeed with the soil. This is no new idea, either, for the fact was always so. For our own credit it is well to maintain that our immediate farming ancestors were not monkeys—but men of the keenest wit and soundest judgment. They took time to learn their trades, however, and if they found difficulty enough with a virgin soil in their time, can we expect to do better than they did with an exhausted soil in our time unless we learn our trades? If we expect to plant a profitable orchard among our grandfather's stumps we must apply our minds to surrounding conditions now as they had to apply themselves then. Where they fought with the sight of a musket, we may need to fight with the sight of a microscope. There are two new microscopes, by the way, ready to be manned and used for our service at the Storrs Agricultural School.

Connecticut health and pomology needs nearer two thousand of them in active service to-day. Let us have schools of agriculture, where the wealthy young men of the country may learn to repay the ground for their bones.

Men value largely what they are taught to value at school. We believe our schools have been in recent years, if not traitors, then wretchedly ignorant of our everlasting landed interests. If we have no schools teaching and proving by actual practice the values latent in the soil; if homes are few across the half of townships and counties, where the earth is loved for its diviner attributes—its innate fitness for the footstool of goodness, its power of producing every conceivable form of beauty; if farm-houses are scarce, in some parts of the State, where an angel coming unawares can get a decent meal of victuals and a comfortable night's lodging; if farm laborers don't know how to plow, chop, and whet a scythe; if farmers themselves have forgotten or have never known how to grow corn and turnips, then it is no wonder that small farming is despised by statute law or the ruling of courts, and that so many acres of our inheritance continue in

worse condition than we received them from the hands of the savage.

If we have gone too far in our educational policy in any one direction, we must change, that's all. We need farm schools, now, to rectify our common schools and teach boys and girls to use their hands in the interest of mechanical as well as agricultural art. Some of our teachers need to be taught how a denial of faith in the earth restricts knowledge and experience of it, and saps the foundations of common honesty and religion.

Faith in the ground is the tap-root of human society and the main stay of the State amidst the crazy mercantile panics that every little while sweep over the land. But faith in the soil is often lost or dislocated. The crafty speculation in "futures," that degrades our manhood, grew naturally out of the priestly speculation in futures that oppressed our boyhood. We shall always require schools of agriculture, to be just and true, as the righteous foundation for other schools and the health of society. It was the devil, you know, who declared to our first parents that they should not surely die by false knowledge. Every dishonesty of this day finds a precedent in dishonest treatment of the land in former days.

The readiest people to admit that a farmer needs to be a close and logical thinker are often those who know little or nothing, practically, about his business. They have learned how accuracy is needful for every business. Some who were born on a farm and spent their early years in the old routine farm employments often fail to understand its recent developments and disabilities, because they never knew them. They judge the farm by what it was in their boyhood. They left it while their mental caliber was unfit to hold the best spirit of the old culture and before there was any chance to catch the newer inspirations. These early graduates may have carried away from the farm physical and mental strength to apply profitably in other affairs but they can never know to a certainty whether the same application of industry and talent would not have brought a higher reward and a more lasting good fortune from the soil, because they never gave their mature powers and energies to it. Merely having been born on a farm does not ensure the farming faculty any more than birth in a stable ensures a good milch cow. Some of our most noted farmers employed their early years in something else, and trained their

minds to close application before they ever cared for farming. The ability to apply one's self counts as power, and the continuous and skillful application of power passes for genius in agriculture.

Pending the time when capital, the savings of the poor, shall be permitted to organize small farm homes for the poor from our neglected territory at home, we shall have to help ourselves, sticking in a home here and there the best way we can, wherever there is an opening. If any one says, "This, after all, is the best way; let the people make their own homes," I reply, in these days of divided labor, it is a wasteful and extravagant way. Why make anything or think of anything, for anybody? If we manufacture parts of homes for market with tolerable success why may we not hope for the art, bye and bye, to make complete homes for a market? It is a Christian idea, you know. The Master said, "I go to prepare a place for you." If we would only let the people go and let all their industries alone, no doubt they would be able to build complete homes for themselves and no mistake, as the birds do. The modern man of "business" too often says to himself, I go to set a trap for you.

During the war, I happened to be knowing to a trade out in central New York, where a man who had recently struck oil bought a ready-made home complete. I forget the price. It might have been $25,000. I never saw a couple of fellows better pleased with a bargain than they were, on both sides. The buyer paid his cash, the seller and his family were allowed to pack their trunks and vacate, while the other party got their baggage into the house in time for the dinner that was waiting. We could do this same thing by wholesale for small farming if we had a mind to turn our building energy that way.

This may seem an entirely fancy speculation, but I'll bet a barrel of turnips that we have a thousand families, in our midst, this minute, willing to buy a thousand bran fire new small farms, ready furnished for business, faster than we can make them. These families would lose half the needful price of a home if they undertook to build for themselves.

Let us consider an imaginary scheme of this kind, for a moment. Locate it, if you please, in some intervale country, with higher land, timber, and upper tables, near enough to build on, where the drainage of the lower land might be too costly for one, but cheap for many, where the height of mill-dams is settled

beyond all peradventure, and no matter if a little water-power is available. For such a colonial experiment in Connecticut, you would choose the most favorable spot you could find.

Some of our utterly neglected and rocky hill-country needs to be let alone to grow wood, or enclosed for sheep and goat-parks, in large parcels, or be bush-whacked and turned into oak, chestnut, and ash openings for cattle and hogs.

Then supposing we could find three good fellows who could work together and wait a little; one of whom could take the measure of a family for its buildings, another could cut out its land as close to a homelike fit as any tailor could make a garment, while the other (or all three) could furnish a little capital for a creamery, canning-house and preservatory, with honest counsel, besides doing some practical work in the surveying line, and adding dignity to the firm. A knowledge of soils and of men is of the first importance. Possibly all these qualities might be combined in one, but the triangle of fit men would be stiffer.

And these partners must have some other business to live by, and begin this new matter for a holiday pastime, so that they may begin with leisure and love for it. I would not in the least object if they had their first talk about it Sunday, after meeting, so holy and beyond every ordinary and narrowly selfish purpose should such an attempt be.

The first family settled should be a picked one, with heads who can wait a little, too, and living so near that they may see the plans prepared for them and know what is going on.

This is pure fancy, but is it an unreasonable fancy? Might we not, each one of us, be able to plant one capable and well-to do family on five to twenty-five acres in suitable new buildings, not too far from neighbors and a market, so they would thrive and grow?

With a good water supply and some wood; with plow-land, not very subject to drouth, and meadow that would always be green in summer; with orchard and garden laid out, and the comfortable things fixed that must be planted a little while before hand, such as the small fruits and vines, the asparagus, and flower beds, the quince-bushes, and a few well-chosen shrubs and shade trees, unless a coppice clearing forms the building site. Doing things by a plan that shall be thought out in every particular, getting our kerosene lamp, even, ready trimmed for the coming of the bride-

groom and the bride, and the son of man, or the welcome daughter, as the case may be ?

Don't you think we have a thousand, pure, faithful working families in the State, who deserve to have this much done for their ready cash ? No ? are there not a hundred worthy—nor ten ? Then you havė a worse opinion of our people than I have—and as bad as the Almighty had of Sodom. One righteous family—as I hinted before, would do to begin with.

Such a plant must begin small, or fearful mistakes might be made. Your rattling village, hurried together, is a tumbling barrel where all sorts of people are made tō polish a few, and wear out many for little or nothing. The destruction of good raw material, badly selected in American colonies, East and West, is a fearful subject of contemplation. The man who has had a glimpse of the torments of it is afraid of them. We must begin things small. I wouldn't plant an acorn or an apple as big as a bushel basket, for fear of the fruit when it got ripe, or rotten, and began to tumble on us.

It was hinted before, that a little water-power would be handy for such a start Well—wouldn't it ? Don't a small farming community have a mighty curious taste for bread of its own growing ? Is there any way of nourishing proper small farm independence unless we provide means for a grist-mill, and for cutting and finishing lumber too, where there is any to cut ? Of course, in Connecticut we might have steam, but we should rather begin with water as our steady-going fathers began. Water, you know could be used for irrigation, to cover any chance of drouth that might bear upon small holdings of land much harder than on large ones.

I hinted before that the small farmer must go for his natural advantages. Water is one of the most important of them all over the world. Are there any laws making it doubtful whether a farmer may use his own water ? Then I vow we should clear all those doubts away at the ballot-box. Unless we do an over-mastering tyranny will surely make slaves of the descendants of revolutionary fathers who thought they had won the freedom of their children forever.

When the mighty laugh at the strangling of weaker industries, a cord already hangs about their own necks.

Whatever they are—hold on to your natural advantages—and

study them—adapt everything to them. Either advantages of person, of soil, water, or climate. They are yours to the center of the earth and as high as the heavens. Among the first of natural advantages on a small farm, is a good husband and a good wife. We can make a whistle out of a pig's tail. We proved that for a hundred years at the Connecticut centennial fire-place. Let us indulge in a reasonable hope then. Don't be discouraged because things happen to us on a farm that were never mentioned in our agricultural newspapers or books.

Where there is a will there is a way. No doubt, on a skillful small farm, we could, if pushed to it, make a silk purse from a pail-full of sows ears, neatly handled. We can make anything we have a mind to with a protective tariff high enough and a liberal expenditure of internal revenue, but this would not be the kind of small farming I am hinting towards. This would be an arbitrary and unnatural manufacture. The right kind would be a growth, and a slow and easy growth, not liable to be threatened at every election.

Now you would like, I know very well, before I get through, to have me tell you of some produce, some crop, or some method or trick of management that you can make a hundred or a thousand dollars on, right away—next season. That would be nonsense—I know better than to try. I don't know your business-training, nor your individual circumstances from Adam's. But you know your own concerns and I can trust you to mind them, with the few hints towards them which I venture, in a tone, a tone merely, an empty sound—except for what little love and human sympathy I may have the grace to put in the sound.

It is of no use to ask me to do the private work of your own minds any more than to do the private work of your own bodies. I can't do for you what a member of your family can, or a neighbor who sees your circumstances, can. There are too many of you for me to attempt to give any one of you a start in life. Was it Byron who wrote,

> "How happy could I be with either,
> Were 'tother dear charmer away?"

You try to ask me questions here, practical questions. I am willing you should, and I may answer them fairly, or parry them, turning the laugh, if laughter is the game we are after. A speaker

may lose his strength without his audience gaining anything, from a crowded or close room but a bad spell of the snuffles. Who hath ears to hear let him hear, and inwardly digest the words of a thousand men, if he can.

We must have meetings. I admit that, although we can't afford to spend all our time in meetings. When Mr. Moody was in Hartford one of our witty clergymen characterized a certain class in constant attendance upon him as "pious soakers." Now don't let any of us continue to be agricultural "soakers" if we can help it. We can't live by letters or books and newspapers alone. These are made to sell, and too often arranged to weaken rather than nourish the farming mind. I have a vast respect for those who never read or come to hear what I have to say.

Small farms can do better than they do with a better selection of books and newspapers. Which? Dip your noses, whenever there is time, in all of them—long enough to get a smell. Cherish a chosen few. Consume books as you do food and pass the translated matter into the energies of your time.

Just think what comfort and strength our grandsires got out of the old and new testaments and the apocrypha alone. This was when all were bound by the same law, and farmers had most time and strength to study it. New laws that they know nothing about nullify the labor of heedless small farmers.

Books are not handy tools, or friendly reminders, amusements, and aids to reflection, as they should be, unless the farmer continually learns to use them by seeing somebody else use them. For this reason I would urge my small farmer to be worthy of having a smart school-ma'am in charge of his family library.

Farmers need occasional fresh company less than most men, but still they must have it. We must call strange speakers from away over the hills to us; speakers that we may doubt—speakers that we may at first disbelieve in; speakers who can attune our souls to harmony, or plow and harrow our minds for a fresh catch of seed. We must do this again and again, as often as we need to learn how by drinking from the ever-moving current of life we help ourselves to live.

Shall the small farmer be a politician? Just as much as he can be and keep his wife in good humor, his crops always coming, and his fences up. He ought to be able to represent his little junk of territory in the town, state, or nation, in time of need. If he is

out of debt and making money, it is only fair that he should take a willing hand in official labor, unless his hay is likely to get wet, or his turnips will freeze in.

Nothing is clearer to my mind than that the parties who are making money under a government and are specially favored by its laws should pay its expenses, according to their profits. Too often the ambitious and capable small farmer is interrupted in his work by the shrewd management of those who do not wish to be bothered with local troubles. Too often he is thrust into some onerous office and spoiled as a farmer by "politics," before he gets firmly seated in the farm saddle. The old writers represent goodness as "jealous," and charge us to "be wise as serpents."

Where agriculture is strong, a well-to-do farmer with nerve and judgment for his appointed business, may become the best and happiest of public servants, helping vastly towards the stability of the State.

When, from any cause, farm labor grows weak and becomes despicable, then it will be better to draft strength from employments that are not of so much public use. It would be cheaper, just now, for society to make road-making or even plain farming more honorable and profitable than rumselling, in order, if possible, to withdraw ability and force from the latter employment. In the recent extreme divisions of labor we find that boys, trained abjectly to one idea, whether of digging or mechanics, become sorely liable to the temptations of drink. Beer of late pays better, they say, than milk, because society has been willing of late to pay genteel bar-tenders better than it would pay gentle small farmers.

Whenever, from time to time, indoor arts get hot, exhausting the energies and vigor of a people, it may be necessary to put an official premium for a brief period on neglected and useful crafts out of doors, to balance things. It is constant, artificial bounty that drives the times out of joint. Yet the small farmer will always be wary of large offers from high places, where the devil may be to pay in the end.

Some of our folks are greatly exercised over the influence of secret societies. Will it help a small farmer any about selling his truck to join them? If it is rather ordinary stuff he has to sell, on a falling market, possibly it might; but no dealer will refuse to deal in the best, if he can get it, no matter if it is not

grown by a brother of the grange, lodge, party, or church. Unorganized people, free buyers for cash, will not let a dealer refuse to deal in the good things that are shown on the street.

The profit in secret societies consists in leaving a large class outside to take advantage of. When everybody is organized secretly, and matched in solid ranks against each other, then there can be no free trade, and organic expenses will consume the profits of organization.

Just now, I suspect—I know nothing, and I don't care to know too much—that our largest secret societies are becoming too popular for profit, and the wiser members would be glad to have grasping, selfish, and foolish people frightened away. Bright mechanics and artisans may find a secret circle too large for their own credit. Private methods in which many are trained will work insidiously, at last, into all human institutions, open churches, and political parties, till wives, even, may unite in some secret society to suppress their tedious husbands. We drown bedsteads to kill vermin, and we smoke ships to exterminate rats. Some know that the recent sinking of a great party was done under some such widespread, saving impulse.

There must be some good in secret societies or there would not be so many sorts of them. Naturalists say there is some good in worms, and we find one kind of vermin needful to destroy another.

A farmer's business is so spread out in broad day-light that he is not expert in underhand tricks. Naturally, he fears and hates them, because, lacking practice, he is easily beaten by them.

Every extinct nation had its secret societies. Ireland, we read of late, has been full of them. I don't know whether it is exactly to the credit of a secret society to have outlasted—like the wandering Jew—many national lives and civilizations. We ought, after making so many awful failures in the world, to begin turning our minds so squarely to the good of every man that no narrow, secret, selfish, wire-pulling organization shall be allowed to sap the foundations and outlive the State we are building.

The devil himself, however, is never so black as he is painted. The old story goes that he once had all the heavenly grips and pass-words. We must not, according to the new testament, or according to the best common-sense of our time, load ourselves down with old hatreds. Rather let them drop into the furrow for

manure, and sow fresh seed that will bear the light and air. If shop and mill boys pull little wires for places in the world, so did Thurlow Weed, so do we all. The most out-spoken man can't tell everybody in a hall or in a newspaper. Some say we need what wires we've got and many more to hold the weak world together. Some of us who can think of no better way, must keep laying wires, perhaps, while others are content to meet face to face and judge for ourselves whether we mutually look as though we had always given a day's work for a day's pay, and one hundred cents on a dollar.

The trouble with secret societies is that puppets can't always tell who may be jerking the long, branching wires they are hitched to.

The small farmer, in close contact with the electric earth, ought to be a conservative social element independent of selfish wire-pulling.

There are symptoms of light breaking in these dark places. Good men see how secrecy may become the meanest cowardice. They grow ashamed of fraternal conspiracies they know nothing about. "Legal" robberies cannot all be hid. Children, marked with the wrong and rapine of these feudal ages, have grown to man's estate. Murder will out. Prosperous crime is daily branded by the burning finger of scorn.

List the whispers of old soldiers—veterans in righteousness as in arms—hear the black stories, sweated out by the friendly warmth of a generous pension list, covering the just and the unjust like God's rain! How that fellow sickened with his own poltroonery in the face of battle—this one sold his famishing comrades for a big profit, and the other palmed bogus dead bodies upon mourning friends!

Rogues do not govern honest men long in secret, because the latter become trained detectives in suppressing the bad impulses of their own hearts.

Should anyone ask what this about secret societies has to do with small farming, I must tell him that the millennial bean cannot thrive in a tangle of selfish, secret vices. The filaments of our invisible fungus may amount in the sum-total of their obstructions, to a second, third, and fourth mortgage upon all our farms. The fear of hidden malice or management haunts and

hunts the timid small farmer around the world, like a dread of the assassin's knife or bullet.

It would be strange if we forgot a hint toward the form of fit buildings and the necessary tools for strengthening small farms. We are not short of good patterns if we bring them together. Some say we ought to cut our fodder green and trample it into a first rate root cellar. The Italian government was afraid to let our American pitch-forks go into use among its agricultural peasantry because they were so sharp. If we wish our government to respect the votes of its small farmers we must keep tools keen. The bayonet-hoe of solid steel with socket shank and full knob handle of ash, made at Collinsville, would, if forged straight, be as good a weapon for defence or offence in a weedy civilization, as the John Brown pikes made at Collinsville.

If small farms are to be rigged for a paying business, farm architecture will have to relearn its trade. We don't produce one-third of what we might because we have no way of preserving our goods. It is a great deal easier to find fault than to make examples men of small means can afford to follow. The rambling structures on some large farms are no better than they should be. A reform of the civil service begins in the reform of farm service.

In this chaos I give nothing but hints, and a charge to study the nature of things before building. There is a new world of increased business, manufacture and trade, scarcely explored in this direction. The tool-market is full of rubbish—good enough, the trader thinks, for those who have never seen or thought of anything better. National growth is held stationary by unchanging farm implements.

Small farmers must learn, of course, what their land is fit for; its history, the character of its top-soil and subsoil; what manures, seeds and plants to put to it; what its fit relations are to other industries around them, and how they themselves and their families can be best related to it and its surroundings. Could I answer these questions alone in one evening, even if I had known one of you all my life, as we say, and you should go to work in my own garden?

Verily, every one of us and everything we see grows different every day of our lives, and there is no such thing as unchanging good or evil. Creation is continually going on. Every morrow is a stupendous novelty that the universe never saw before. If I

could answer these questions, if I could tell what the morrow would bring forth for us, we should lose our interest in life. Our fathers had the same idea in briefer terms. They said we must "live and learn."

Yet we can and do help one another, although we never see each other. Each of you holding some useful place well, like every faithful drop in a bucket, helps every other one of us to hold some useful place well. That was the feeling as a strong common-sense, which gave Connecticut a name we should cherish, as "the land of steady habits," and around that feeling, as a common-sense, lie clustered the essentials of farming. Hold your place well.

Vital questions of taste are continually coming up on a farm—especially among beginners. Which horse, which cow, which variety of grain, which potato, onion, turnip, beet, bean, pea, strawberry, apple, grape, or peach? Which cucumber, squash, or melon? Innumerable practical topics of this stamp beset the tyro, and they are of fearful importance when a fellow has to look for his money coming back to him out of the ground.

A totally ignorant person, if poor, better work for his board and what more he can get, with any one who will teach him. A man of cash and sense may find the best of teachers in a good hired man. Moderately ignorant people can peruse the lines in their gardens, alternating with the lines in books and papers, or run around and read other people's farms and gardens. Only those will succeed greatly who learn, after all their enquiries, to judge for themselves.

In all matters of taste, we must judge for ourselves, else how shall we have any faith of our own in what we do? If we ask any agricultural priest or prophet to tell us which strawberry to plant, and pin our faiths exclusively upon his old sleeve, we are liable to "get left," because if at all conscientious, he is unwilling to have a greenhorn bet heavily on the entirely new but reasonable hope which an experienced party may be glad to risk his pile of manure on.

We must be theologians enough to know what is good, yet always ready without bigotry to modify our judgment according to the latest gospel. If we grow apples or turnips by the taste of another, we shall act like fools when we are driven to a strange market, with no guide but the taste of another. Until we have come to years of discretion and judgment of our own constantly

at hand, respecting farm goods, we should touch them lightly or remain studying with those who do know. Yet faint heart never made a profitable crop.

Whatever we undertake to do let us do it better than we did before, or have seen it done, if we can. Beat yourselves every time. Never mind whether you exceed your neighbors or not, beat yourselves. What we admire in an animal or plant we admire more in man—that is growth.

If you are making beef, or pork, or mutton, or milk, or butter, or cheese, working oxen or trotting horses, make them better next time, especially if you make things for the judgment day of the market.

So of vegetables or fruit products. Let withered and inferior goods come by railway. Don't allow the market to know of your going back in quality any. It will despise and never forgive you if you do, as you despise and will never forgive the weakly animal or plant. I am not hinting that you should lie about the quality to cover a failure either. Manufacturers dispose of their mistakes under another name. The nice farmer can feed them to his cattle and pigs or chickens.

Again, don't try to do too much of a kind nor too many kinds of things. To excel in leaping you can't jump in all directions—you must throw your heft towards one point.

While we are young, doubtless we shall have to prove many things and scatter trials in various practice to find our bearings and form our minds; but after forty years of age, more or less, we must concentrate and intensify our work.

Then we shall begin to see, the sharper we look, how much there is to see, and how very little we absolutely know.

When we bend our minds to the production of one or two staples—the commonest, the easiest, the ones we supposed we knew all about years ago—then small farming jumps in industrial importance. Then we shall find our chosen branch of agriculture a most absorbing pursuit. Then we shall know the unlimited chance of failure and infinite progress in every direction, passing the limit of one short span of life except to make the feeblest beginning.

At that point we shall have no fear of competition. We court it, rather, to help in our studies and share in our labors, for in the

field of excellence the toil is always hard and the workmen always few.

It may be true, as men say—" When you get your name up you can lie abed mornings," but that is near the end.

Dr. Bowen. Before this meeting adjourns, I desire to express my appreciation of the efforts of the citizens of Rockville to entertain the members of this convention, and in expressing my own sentiments, I am sure that I but echo those of all its members. The people of Rockville have opened their homes for our comfort and entertainment, their mills, shops, and offices, for our inspection, and this church for our convenience here to-night. I would move that a vote of thanks be extended to them for their kindness to us.

This motion was unanimously adopted.

Col. Warner, of Pomfret. I am very glad that Dr. Bowen was so thoughtful as to give utterance to his feelings, for I am well satisfied that all the members of this convention most heartily endorse every word that he says, for we have all felt from the first day we came to Rockville until this blessed hour, that we have been greatly indebted to all its inhabitants for the many acts of kindness that they have tendered to us, and the sympathy and kind feeling expressed. The very atmosphere of Rockville has told us that we were welcome here. But, equally with the citizens of Rockville, it seems to me there are others who should receive the recognition of this convention. There are others who have been instrumental in making this convention a success—a magnificent success. There is a power to which we are indebted, a power that is strong, that makes and unmakes nations, and, when rightly directed, overcomes all obstacles. To that power we are indebted a great deal in connection with this convention. I refer to the public press; and I move, sir, that this convention tender a vote of thanks to the press for their hearty cooperation in connection with this convention. Carried.

Mr. Sedgwick. Those of us who have attended the agricultural conventions the past few years are aware of the fact that a great deal of the pleasure of these meetings, and a

great deal of the interest, have arisen from the fact that we meet together, we see one another, we communicate our ideas to one another; in other words, that it is a sort of annual picnic with many of us, and that our enjoyments are heightened by the way in which we are received at the hotels. Now, sir, we have been very fortunate since our arrival here in that respect. As I came into the church I drew up a little resolution, which I wish to present:

*Resolved*, That the thanks of the convention be tendered to the proprietor of the Rockville House for the courtesy and kindness shown to his guests for the past three days, and for the free use of the hall attached to his house for the meetings of this convention. Carried.

Mr. Augur. Fully agreeing with what the gentlemen have said who have spoken heretofore, and recognizing the fact that we have come together from all parts of the State, and other States, over our railroads, who have offered to give us free return tickets to our homes, and feeling that this is a great favor, I desire to move, sir, a resolution of thanks to the railroads who have done this. Carried.

The President. In behalf of this Convention, and of the State Board of Agriculture, I would tender our most hearty thanks to the citizens of Rockville, who have attended this meeting this evening. It has been a great pleasure to meet you here, and we hope you have been well repaid for your attendance.

Rev. Mr. Forbes. Before you adjourn, please let me say one word. I have been waiting for some person outside to respond to these resolutions which have been offered, but I want to say, gentlemen, that we have been delighted to have you among us. I was glad to hear the lecturer say to-night that he had had a good time here; that you had had a better meeting than at any other place in the State. Perhaps there was good reason for it. Perhaps he did not know that he had got into the best place in the State; but that is the fact. We are founded on a rock here, and not only have we the granite beneath us, but we have three churches here within a stone's

throw, and we consider that as one of the great needs that has been alluded to. And we want to express our thanks to those who were willing to accept the invitation to come into the prayer-meeting, for we believed that it was a fit thing to mingle prayer with the consideration of the great subject in which you are so constantly at work. You may wonder why we are so much interested here to-night. It is for one of the best reasons in the world, sir. You were going to talk about small farming. My dear sir, we are cut up into such small sections that our farming is almost infinitesimal. Our gardens are almost turned up edgewise. We are trying to see how much we can get off from every rod of land. We have been drinking in your address, and when spring comes, we shall hope to profit very largely by its suggestions.

We rejoice with you here for another thing. You have brought with you, Mr. President, a body of sober men. We are indebted to the farmers of this convention, and of this State, for examples of sobriety for which we want to express our profound thanks. There was a time when farmers were not the most sober class of men; there have been times when farmers were not the most honest sort of men; and this reminds me of a single remark in the address. The lecturer says we want to make the most of ourselves, we want to make the most of our work. Now, at the present time, the farms are wonderful in their productive power. Take, for example, the matter of beef. Time was when we could not get more than six, eight, ten, or twelve pounds of steak out of a quarter, but at the present time, we can get three hundred pounds of sirloin steak out of an ox, and have nothing left but the hoofs and horns! For this we are indebted to the farming of the present time. We hope that you will come another time, and when you come the next time, perhaps you will be able to show us some other direction in which you have exceeded your history in the same way. We welcome you most cordially this time, and when you go, you go with our grateful thanks that you have been among us, and we want you to come again as soon as you can.

The PRESIDENT. According to the arrangement this afternoon, when this meeting adjourns, we are to adjourn to meet at the hall for the closing exercises. If no gentleman has anything further to say, we will adjourn to the hall.

## CLOSING MEETING AT THE HALL.

The PRESIDENT. We have with us two gentlemen from abroad, from whom we are very anxious to hear before the close of this meeting. I will introduce to you Mr. Sessions, of Atlanta, Georgia.

### ADDRESS OF MR. H. M. SESSIONS.

MR. PRESIDENT:—This is a very unexpected call on me, and I hardly know what response to make. I was born and bred in a neighboring State, only a few miles from here, and made it my life-long residence up to twelve months ago, when I broke loose from my moorings on New England soil and wandered with the migratory birds to a southern clime, and have been there one year. I went to the city of Atlanta, through the States of Kentucky, Tennessee, and a part of Northern Georgia, and during the exposition, I was welcomed on all hands and on all sides, by southerners. Knowing that I was from Massachusetts and was an exhibitor of a little "trick," as they call it, for keeping butter—glass butter jars—they wished to express to me their welcome and their desire to receive northern enterprise and capital to help develop the great resources of the south. They claimed that they were doing great things at the exposition. "We here at the south have great resources," they said, "and we have got up an exhibition equal or superior to the Centennial."

I am now connected with the agricultural or industrial department of Atlanta university, a school for the colored people, established by the American Missionary Association of the Congregational church. They have over three hundred students; they have a corps of twenty-two teachers and superintendents, with their families—all white people from the north. The State of Georgia divides the appropriation for agricultural colleges between the white and colored people. Our university gets an appropriation

of eight thousand dollars a year from the State for that purpose, which helps pay the bills. As this is an agricultural meeting, it may perhaps be more proper for me to speak of the institution in its industrial rather than its religious or educational department. The last, both in morals and education, is doing a great work for the colored people of the South, and so far as the industrial department is concerned, it meets the approval of every southerner, for they approve of educating the colored people to work, as they consider that their sphere, whatever else they may think of them. The colored people are all willing to learn and anxious to learn. They have no other desire. They come there for a purpose, and they have no other desire than to learn what will help the members of their race to rise in the world and occupy the positions that God designed they should occupy as men among men; and as this nation has given them the right of suffrage, the right of free men, they want to so prepare themselves that they shall be worthy of that right by their future actions.

We have a farm of sixty acres connected with the university, within one mile of the depot, the city extending a mile and a half from the depot in all directions. The city is built up to our land, and is extending around it and beyond it. When I went there, they kept one cow, one horse, and bought most of the feed at that. We have improved the land,—taken up about twelve acres. On some of the land we have raised two or three crops, and during the past eight months we have kept and are now keeping ten cows, four horses, some calves, and plenty of pigs. The crops that we have raised have been mostly garden vegetables for the table, we having some two hundred and forty boarders. We had two crops of potatoes, one in June and the other harvested in October. Sweet potatoes began to be ready for use the first of August and continued until the first of November, being all dug at that time—enough to last until Christmas. Large quantities of all kinds of early vegetables were raised, and through the generosity of the well-known seedsman, Mr. Gregory of Marblehead, Mass., we received a supply of seeds for our garden, including some sixty varieties, worth probably twenty-five or thirty dollars. We planted those, had every variety labeled with the proper name on a white painted stick, so that all the students could observe the growth of every plant. Twenty varieties of grass were sown on a plot as a specimen plot. The success of that

experiment can be better reported upon hereafter than to-day. We had also forage crops, raised more especially to keep cows. There is no chance for cows to graze, there being no grass in that section of the country, the hard clay preventing grass from standing the summer heat. We raise the grains, millet, and sorghum. We cut three crops of sorghum from the same roots of amber cane for feed for cows, and large quantities of millet, and rye, and clover, were raised and dried for feed. We dried crab grass, also, for feed, which is the knot-grass of our gardens, coming up, and heading out in mid-summer with a three-forked flower spike. It is very prolific there, and, when dried, makes fair feed for cattle.

The soil is a red clay, washes very easily in the rains, more from negligence than anything else. For the past ten or twenty years, the water has been allowed to run in the same places, and of course large gullies are made. The ground is cut up with rifle-pits extending around the city two-thirds of the way on a double line, half a mile apart, and on every hill there are earth works, which either remain as they were at the time of the war or have been leveled by the improvements of the city, and where a well was dug forty feet deep twenty years ago, it is the same as it was when it was dug, never having been stoned. The walls are perfectly hard and perpendicular. They cut holes in the sides of a well for persons to climb up and down when they wish to clean out the well. That was a great marvel to me, how it could be that the soil could be excavated and a perpendicular wall would remain for years. The clay dries in the sun, like bricks in a brick-yard, that are dried in the sun before burning. The soil, if worked when wet, will harden, and ten years will not eradicate the evil effects of it by breaking the lumps, and when it is too dry, it cannot be plowed any more than a macadamized road. So we jump at our chance to plow and hoe between the rains, the showers, and the drouths. It is very difficult to manage in that way. When I first went there, I thought that a man would surely starve to death if he undertook to get a living by farming around Atlanta. But I have altered my mind, because I have raised the best crops I ever saw grow anywhere, with thorough cultivation and plenty of manure, which I get in the city. They hardly know what to do with it. I can buy it for fifty cents a load, half a cord to the load, and can get a great deal for simply drawing it away.

The question is often asked me, whether the colored men, or the boys and girls in our school, are bright and are capable of learning, if they can study in classes, and all that sort of thing; if they can make improvement worth the efforts which are made for their education? I may say that considering their inheritance for past generations, I think they are making wonderful improvement. There are in the South, perhaps hundreds of thousands of native Africans, who were brought over as slaves, still living, and we can expect no more from them than if we attempted to educate them on their native soil; but they are here, they are here to stay, and what duty has this nation or people towards them? But perhaps there are many more of their children here, only one step more advanced, and what can we expect from them? They have hardly learned our language, much less have they the intelligence which is induced by constant observation and by inheritance from past generations. But as regards the class who come to our University, I must say they are making wonderful advancement. If you could hear the discussions at the public exercises of the debating societies among those boys, you would, I think, admit that they compare favorably with any college exercises among our own young men. They seem to have intelligence enough and observation and reading enough to make a good speech, and surely they have a good use of language. There is one point in the development of their minds that is wonderful, and that is the memory. They will commit to memory wonderfully. That faculty of the mind has been educated for generations. While in slavery they had no other way to learn, they had no other way to store up knowledge, only to remember it, not knowing how to read. I think they are making great progress and are worthy of the efforts that are being put forth by missionary zeal and private enterprise. And yet, what is being done in this way towards their education is but a drop in the bucket; it never can reach the masses. Millions have not been reached yet. And this government, if it does not want a nation of paupers and criminals which are the result of illiteracy, must take this work in hand and educate them.

The PRESIDENT. We have with us a gentleman from Maine, whom I am very happy to introduce to you—Mr. Z. A. GILBERT, Secretary of the Maine Board of Agriculture.

## ADDRESS OF MR. Z. A. GILBERT.

Mr. President, Ladies and Gentlemen:—I feel that it would be an act of impoliteness on my part to refuse to speak on this occasion, or to fail to respond to the compliment of an invitation, in consideration of the courtesies and attention I have received during my brief visit among you.

I come here from the eastern border of the galaxy of States called New England, to meet with the farmers of this other extreme in your deliberations on this occasion. I come to shake hands over the distance lying between those extremes with these co-laborers of the farm, and also with this Board of Agriculture, these distinguished gentlemen who are engaged in the work of the diffusion of a higher knowledge and a greater interest in this occupation in which we are engaged. And in coming here, and in meeting with you, I wish to compliment the character of the meeting which I have found here. Having been connected in some capacity or other for many years with work of this kind, I think I speak with something of knowledge of what is being done in this direction in New England, not, however, having had an opportunity of meeting with you here before. I am happy to see that you draw together representative farmers from almost every quarter of your State; that here you have been enabled to congregate so many as you have of the thinking, intelligent, wide-awake, determined farmers of the State of Connecticut, realizing as I fully believe they do, and which is shown by their presence here, that the prosperity of the State depends upon this industry, believing, as the speaker has said, that whenever the farming industry of the State prospers, then the State prospers; and it is not confined to the State, but the prosperity of the country at large is dependent on its agriculture. I have felt pleased to meet here so many young men as I have found among this assembly. Although the numbers have not been so large as I could wish, or, doubtless, as you wish, still I have seen a goodly sprinkling of the young men of this State in attendance on these meetings. This is an encouraging feature. It is another compliment to the character and to the influence of these meetings; it is a suggestive fact, that from this brief contact with the farm pulse of your people here, I find that you have conditions not greatly unlike those which we

find in our own State; and perhaps I ought not to say, Mr. President, it is a pleasant fact which I discover (for it ought not to be pleasing), that you have here some, at least, of the discouragements which we workers find in the State of Maine. There is a common sympathy, and therefore I feel that it is not unbecoming in me to say that I do feel pleased, in one sense, to find that you have these discouragements. They are not insurmountable, and you are taking the right steps (and that is another pleasant feature), to overcome them.

I have learned from the exercises here, from the addresses to which I have listened, from the discussions and from the remarks which have been dropped by individuals, that here in this State, as in my own—and I think I may add, all through New England—the social standard of the farmer, the social standard of farm life, is not on that elevated plane upon which you here would be glad to have it placed. I have felt this seriously in my own State. There is a feature of the life of the farm in this direction which is hard to meet; yet for this there is a remedy, and that remedy lies within the reach of the farmers of Connecticut; and the well-wishers of society on the farm, the well-wishers of society at large, must not expect that any elevation in this direction is to be attained, or any correction of this defect in our society is to be remedied, without effort. We need never look for others to come in and lift us up out of our present position, but we, by our own efforts, if we will, can go to work and build ourselves up. I learn, too, here, that your young men are prone to leave these farms and flee away to other lands of promise. So, too, do we in Maine meet this difficulty, and it comes home to me there, and the same thought has been suggested to me here. Is there not, possibly, Mr. President, a fault on our part in this direction, as well as in the social direction? You are making efforts here in Connecticut, as we are in Maine, to educate your young men—to educate them in connection with, and in sympathy for, farm life. Special schools are established for that purpose. We have had many forms of special schools to fit our young men for professional duties, and when they graduate from those schools, and step out into professional life, are not those young men, in the esteem of the community, placed in positions higher up in the social scale than if they had never been schooled in those directions? Do they not start out in life from a higher plane, from the fact that

they have been educated to the special work in which they are about to engage? Does not society accord to them those higher positions, and do we not say, when here and there one of them breaks down and comes to the level of common life, that he has fallen? If he has fallen, it was because he was placed in a higher position, and had room to fall to the common level. Now, as these young men whom I have met here go out into the farm life of Connecticut, are you, fathers, are you, mothers, in this Board of Agriculture, prepared to accord to them higher positions in this life on the farm, in this social standing, from the fact of their having been educated in these special directions, and for this special work? It is a duty that devolves upon every individual in Connecticut to honor with the highest commendations, with the most earnest encouragement within his power, every one of these young men who is ready to set up his standard for the farm. Are you prepared to do it? I trust you are. If you are, you have got a step in advance of the State of Maine. Young men graduating from our common schools, who are prepared, through their better and higher intelligence, by reading the public press and agricultural literature, to take these better and higher positions,—shall we not accord to them these positions which they are qualified to fill? If we would elevate the standard of farm life amongst us, we must encourage our young men to fit themselves for any position in these directions. We must give to them our support, we must give them every aid to start them out in these efforts for a life among us. Will our young men then be looking to other States for what is here within their reach? Shall we not find them in these rural towns, and at work on these lands here, and among us? And will they not find then, when this social atmosphere is so pervaded with a willingness and desire on our part to help them, to elevate them,—will they not find sufficient inducement to remain here? Will they not then realize that we want them, that we are willing to use them, that we propose to use them? That when they become fitted by contact with the world, we are going to take them and put them into still higher positions, and thus, while we honor them, honor the farm. It is within our power to change the whole aspect of social life on our farms, when we put forth our efforts to do it. And, Mr. President, just such meetings as you have been holding here are a work in that direction; and the influence of these meetings does help im-

mensely. And the people of this village, these townspeople, in the reception which they have given to this meeting, in their cordiality, in the respect, the high respect given to it, in the appreciation manifested on every hand, have done a good work. This Convention honored itself, in this same line of influence, by adjourning this evening to yonder church, and thus dignifying and elevating the character of the meeting which you have held. This board did itself honor in accepting the invitation thus honorably extended to it.

One word more and I am done. The ladies who have given their attendance at the meetings, and especially the large numbers in attendance this evening, are exerting a still greater influence, and when they thus honor by their presence and by the interest manifested in its exercises such a meeting, there is an influence going out that is greater even than the influence of its deliberations,—greater in its effect to elevate the social standard of the farm, and encourage the young of the rising generation to remain with us and till the paternal acres, and rise up into positions of influence among us.

So you have my congratulations. So my wish is that you may go on, and that yearly, as your meetings are continued, this social standard may be elevated, this educational influence going out from these meetings may be extended, and their usefulness increase, until we have built up an aristocracy of the land, which shall pervade the community.

Thanking you for the invitation to speak, and the attention which you have given to my words, I leave the stand.

The PRESIDENT. Ladies and gentlemen: It has always seemed to me that the farmers of Connecticut owed a great debt of gratitude to a few old war horses in this State who have been in the front of the battle, fighting for them these many years. Among them have been a Hyde, a Gold, a Webb, a Hart, an Olcott, a Bill, an Augur, a Day, and many others; and it has always been a mystery to me how these men have been so much of men as they have shown themselves to be. But as I have sat here on this platform and seen their better halves, whom they brought to grace this meeting, it is no longer a mystery to my mind.

MR. DAY. One word, if you please. I have been connected with the Connecticut Board of Agriculture for a longer consecutive period, perhaps, than any other member. I commenced when our numbers were small, and but few knew what the Connecticut Board of Agriculture meant. I have seen its meetings begin from the smallest beginnings, and rise to their present large numbers. It was my pleasure to attend the meeting at Newtown, where I saw a congregation of men of which I was proud; I was proud to be called a citizen with them. Individually, I came to Rockville a stranger to almost every person here. I go away feeling that I am a friend to them, that they are friends to me, that we are brothers. And when I contemplate the strong hold that the Board of Agriculture is gaining, more and more, upon the people of the State, and the increasing interest that is excited by its meetings, I am sure that there is hope, and the strongest hope that the young men who have been wanting to leave the farm will conclude to stay.

I do not wish to extend my remarks, for the reason that we have with us another distinguished gentleman, from whom I know you will be glad to hear—one of the progressive farmers of the State of Massachusetts; a gentleman who cultivates one of the finest farms, and has the finest herd of Jerseys in the Old Bay State, and who, as I have said, is a progressive, working farmer,—the Hon. O. B. HADWEN.

## ADDRESS OF HON. O. B. HADWEN.

MR. PRESIDENT, GENTLEMEN OF THE BOARD OF AGRICULTURE, AND BROTHER FARMERS:—I feel a little embarrassed in rising here, after the complimentary remarks of one of your distinguished members. I had thought of saying a few words only to encourage agriculture.

When I was a young man, I did not leave the farm for the city, but I left the city for the farm, and that has been my pursuit all my life, from an early age; and yet I confess that I am still a student, and ever expect to be. Notwithstanding all the disadvantages under which farmers labor, whether young or old, I have seen great progress within the last several years, and I attribute this

progress in a marked degree to the efforts of your Board of Agriculture, and the Board of Agriculture of Massachusetts, both standing shoulder to shoulder in the promotion of this great work. And I feel to-day that there is more encouragement for young men to educate and fit themselves for the special purpose of farming than ever before. We old men have groped along on uncertainties, guessing most of the time, with little positive knowledge appertaining to our occupation. But the young men who are coming on the stage have great advantages, and I have no doubt that as time progresses farming will take as high a stand-point among the industries of States and Nations as any other calling.

Mr. President, I congratulate you upon the success of your meetings, upon what you have done to promote agriculture. I came here quite late, and have had an opportunity to listen only to a few of your lectures; still, I shall carry home some things that will be of great value. And one little thing just occurs to me. Your lecturer told us to-night that when we want to do a good thing, we must beat ourselves; and when I want to beat myself in farming. I find I have to come to Connecticut to catch some new ideas. I am bound to confess, in common honesty, that the highest result of horticulture I have ever seen, the best gardening, the best products I have ever seen, I have seen in the State of Connecticut, notwithstanding all our boasting in old Boston, and in Massachusetts. I do not say this to flatter you, gentlemen of Connecticut, but I say it as a fact.

And now I am going to refer to one or two things that I have seen, and I think I can convince you in a very few words that I am telling you the truth. I want to speak in relation to strawberry growing, which is quite an interest in some sections of this State, and some of the most intelligent growers live in the State of Connecticut. I visited a gentleman in this State and went into his garden a year ago last September, and I saw a few rows of strawberry plants that had been set out the first of August. The diameter of those plants was equal to a peck measure, and they had only had one month and twenty days to grow in. I was perfectly astonished. I asked the gentleman if he would give me a report of the product of those plants this last season, and he has sent me the report. He had six rows of strawberry plants, with sixty plants to the row. Some of those plants have borne the last season three pounds of strawberries; that is 180 pounds

to the row of sixty plants. Among those strawberries were berries that weighed $2\frac{3}{4}$ ounces, and were $2\frac{1}{2}$ inches through. He said it was not fair to measure strawberries by the circumference, the only fair way to measure them was by avoirdupois.

Now, Mr. President, perhaps you will not wonder that we in Massachusetts have to come to Connecticut to learn how to grow even strawberries. And although I speak only of the strawberry, I might, if I had time, include many other things.

Thanking you for your attention, and expressing my obligations to the gentleman for calling me up, if I have said anything to show your people that you are doing well and making good progress, I am happy to have done so.

Mr. AUGUR. I am not going to occupy the time of the convention at any length this evening, for it is time we should close. I simply wish to make a remark or two.

Mr. President, it has been my pleasure and my profit to go about Connecticut somewhat, from the rising *Day* on the east, around by the strong *Webb* of the City of Elms, over to the *Gold*-en horizon of Cream Hill on the west,—and I will say before this meeting that it behooves us as farmers to assert our rights and our standing. I will say that all over our State are homes and farms, and, between the Atlantic and the Pacific, there are none which are the abodes of more contentment and happiness.

A word or two more, and I am done. We want, if we can, to make two blades of grass grow where only one has grown before. Mr. Downing, in his description of the fruits of this country, gives the origin of more than one hundred of the choice varieties of fruit under cultivation in America to Connecticut, more than eighteen to the City of Elms, and a great many to the city of Hartford.

Now, gentlemen, we have here a few packages of seeds. We are willing to move forward in this direction. Here are some packages of grape-seeds, which were saved from the premium dishes of grapes which were exhibited at our State fair—the best of the best. Mr. Nichols, the reporter of "The Country Gentleman," remarked to me that it was the finest

collection of grapes that he had ever seen in New England, except at the exhibition of the Pomological Society in Boston. We have about three hundred packages of these seeds, which are labeled with the names of the persons who raised the grapes, and if any of you will come forward and accept a package or two of these grape-seeds, and promise to take care of them, put them in the earth immediately, and let them be subjected to the action of the frosts this winter, and in case you get a new and choice variety, report it, we would be very glad to have you accept them.

We have on our tables a few dishes of fruit from different parts of the State. Some of it would be very much better next month than now—you will have to take your chance; but if you will be pleased to accept it, such as it is, we shall be most happy to share it with you.

Mr. Day. In view of the many courtesies that we have received, I am not willing that this love-feast should end until I offer a resolution. I move a vote of thanks to the Hon. Marshall Jewell for his courtesy in extending the free use of the telephone to the members of this convention.

Carried.

Mr. Augur. One resolution more. I move a vote of thanks to those who have made contributions to our tables of fruit, grain, vegetables, etc.

Carried.

The President. Gentlemen and ladies, I wish to return you my most hearty thanks for your support of the Connecticut Board of Agriculture during these meetings.

Adjourned, *sine die.*

# REPORT OF P. M. AUGUR, POMOLOGIST OF THE CONNECTICUT BOARD OF AGRICULTURE.

## FRUIT CROP OF 1882.

The yield of our apple orchards for the year was on the whole light; in many towns in the State the supply was insufficient for home consumption, and the fruit produced of inferior quality, and yet, in some towns, orchards bore abundantly and the crop found a quick market at remunerative prices.

The crop of pears, we think, was universally light.

Of peaches almost none at all; the month of December, 1881, was exceptionally warm, so that the ground remained open and free from frost until nearly the last of the month; the early part of January, 1882, followed with the cold intense, and probably on the night of January 24th, when the thermometer showed 14° below zero, the destruction of the fruit buds took place. So that except a very few rare cases we had no peaches of our own growing, while in 1881 those who had bearing orchards had fruit in abundance. The exceptional cases of peach bearing in 1882 seem to be these; in the vicinity of New Haven here and there a few peaches were grown, and in some other instances, where certain mitigating influences tempered the atmosphere a little, peaches were produced in small quantities. Again in the severe frost of October, 1881, the peach suffered much damage, more especially in valleys, so much so that hundreds of young trees were killed outright, while those on hills escaped that frost, but the fruit buds were killed January 7th, following. To-day, January 1, 1883, orchards on high elevations, like our own, are safe and full of promise, while in low, sunny exposures some trees have lost seventy-five per cent. of their blossom buds already, but unless unusually severe cold should occur, we expect a peach crop, at least in many parts of our State.

## PLUMS.

This fruit, though only raised in a small way, yielded tolerably well, though in some localities suffering like the peach, and it is fair to presume that orchards of this fruit enclosed in poultry yards, or where special means are used to destroy the curculio, may reasonably be expected to bear fruit, annually, especially such

varieties as the Lombard, Richland, Shropshire Damson, and some others.

Quinces produced moderately well, where well cared for.

The grape yielded well in cultivated vineyards, and all healthy growing varieties, even those ripening late, matured their crop well where not over-loaded.

Cranberries made a very light yield.

The strawberry, raspberry, and other small fruits, did reasonably well.

### OUTLOOK FOR THE FUTURE.

Fruit growing is to be more and more of two types. First. Market orchards. Second. Amateur fruit gardens; the first for profit, the second for pleasure and family use, where personal satisfaction rather than profit are sought. Our market orchards, where crops have failed the past year, are generally promising to produce the coming year; if the present winter and coming spring are favorable, it seems now as though there might be a more even rate of production than heretofore; that is, that the strong tendency to over-bearing in even years may be changed to a more even rate of bearing, or more odd-year and less even-year orchards. Should this be the case it would be a boon to both producer and consumer.

Again, planters of market orchards are seeing the folly of planting a great number of varieties.

For all New England, except the extreme north, the Baldwin, as a winter fruit, may with safety be planted for the larger half of most market orchards, except on light or sandy soils; and for the remainder, a very small number of kinds, quick in market, and known to succeed in such soil and locality; but the planters of market orchards cannot and will not as a rule plant a long list of unknown varieties; they will cultivate better, prune better, will learn better to escape insect ravages, and when having fine abundant crops, will save their fruit more closely, first, by evaporating the windfalls; second, by using the sound rejected apples in jelly making; third, by having approved fruit-houses on best principles to hold the crop until remunerative prices can be had; with a close attention to all these points success may be expected.

The same may be said of the pear or peach, five varieties are

better than fifty, only take the best five,* and be sure the soil, exposure, altitude, and culture are quite right for the varieties planted.

Climatic influences, favorable and otherwise.

Nowhere, since man was driven from Eden, has he found a spot free from difficulties; from the Atlantic on the east to the Golden Gate of the west, difficulties are found at every step; the experience of Connecticut will vary from that of Minnesota, Maine from Georgia, Delaware from California, in all localities are special climatic influences, to which we must apply the law of adaptation; varieties well adapted to our State would often be worthless in extreme Northwest or South and the reverse. In the early times of our Colonies, when a considerable part of our State was primeval forest, the climatic conditions were highly favorable for fruit growing; the humidity of atmosphere from the exhalations of forest invited frequent showers, the early and the latter rains were comparatively sure, while now the enormous waste and destruction of our forests cause an unusual aridity of atmosphere, so that clouds which might otherwise water the earth, when passing into the overheated air are absorbed or dispelled. Now if we can, as will be hereafter indicated, plant our waste land to valuable forest timber trees, a two-fold benefit will result. First, a valuable timber crop. Second, an increased humidity which will be beneficial to all other crops, as well as promotive of the wealth of man; tending to modify the intensity of heat and cold, flood and extreme drought.

By the census returns we find the acreage of woodland in our State is increasing; only, let it be of valuable timber growth, instead of valueless poplars, cedars, or underbrush. But the fierce winds which pass through our orchards on a winter's night, cutting almost like a burning flame, come over many bleak hills which were once dense forest breaking the force and tempering the severity of cold.

When will our state and national governments aid in staying the wholesale and wanton destruction of the great Adirondac and other forests, from which every northwest gale soon courses through our State, often damaging our fruit production?

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*For five pears in succession—B. Giffard (double worked), Clapp's (picked early), Bartlett, Onondaga, B. d'Anjou. Five peaches, Mount Rose, Oldmixon Free, Wheatland, Crawford Late, Stump.

On the other hand, nature has been bountiful with us; we have neither the climate of Sahara nor Labrador, but can raise all the fruits of the temperate zone by reasonable care and good culture, by a judicious selection of orchard sites, and proper varieties of fruit. Having done what we can for the general good by our own timely action, we must make the best of our surroundings and abide the results.

### COMMON MISTAKES IN PLANTING MARKET ORCHARDS.

First. In planting apple orchards on very high-priced land, contiguous to large cities; such land is more called for for market gardens and the production of small fruits which require quick handling; while *hill-land*, in country towns, valued at a much lower rate, will often produce more valuable apples, with better keeping quality. An old distiller of cider brandy, in one of our Connecticut towns, in a discussion on apples, made this statement: "Cider made from apples grown on sandy loam, in the Farmington valley, will make one-third less brandy than from the same kinds of apples grown on the hills back toward the mountains, and there is the same difference in their keeping qualities."

Second. In using inferior trees for orchard planting. The choicest-grown trees, at their price, are always the cheapest. To nurserymen we desire to say: Use the most carefully-selected seed; grow and propagate varieties on the best principles, with best care, and then charge enough to compensate for the extra cost of production.

It costs only about $10 per acre to plant an apple orchard of the best trees of the best varieties; therefore, there is no excuse for using aught but the best. And yet there are multitudes of cases where ten-fold loss has resulted from carelessness on this point.

Third. In planting too many and ill-adapted varieties. Nine-tenths of the apples shipped from this country to Europe are Baldwins. The Rhode Island greening is productive and popular, and, in some sections, the Roxbury russet; but, whatever varieties are chosen, have but few, and those the best-adapted varieties.

Fourth. In lack of systematic care, culture, and management of orchards. Let the orchard-planter acquaint himself with the best methods of cultivating, pruning, and general management, and reduce his practice to a system.

THE AMATEUR FRUIT GARDEN, WITH ADVICE TO PLANTERS.

The lover of choice fruit, having a given area he desires to plant, begins to speculate, first, as to varieties to choose for his ground. Should he chance to fall in with a tree agent, he would probably be advised to choose certain novelties at high prices, or possibly certain varieties that there is a surplus of in some commercial nursery. In either case, he will have nine-tenths to graft over when they come into bearing. There are described, in the various treatises on fruit culture, several hundred different varieties—*poor*, *good*, *very good*, and *best;* and those which are marked "best" are often very poorly adapted to certain soils and exposures, and some will surely disappoint the general planter. Again, certain varieties are exhibited at agricultural fairs, and win the admiration of every beholder; and lists are often made up on such occasions which are sure to disappoint the planter.

To a beginner in tree-planting we would say: If you would save time, money, and disappointment, consult the best practical planter in your vicinity, and he will cheerfully give you experience which has been costly to him and will be a great saving to you. A dish of magnificent "Flemish Beauties" may be exhibited by me, the "White Doyenne" by my neighbor Jones, and the "Beurre Diel" by Parson White; while neither of us would recommend either variety for successful planting, though all take first premiums at the fair.

A variety may occasionally produce choice, beautiful specimens, of high quality, and yet not be worth the time and space given it. Again, certain varieties will, under high culture, do remarkably well and yield satisfaction, while with neglect they would be utter failures. Again, certain varieties set so heavy a load of fruit that without thinning the fruit would be nearly worthless, but with proper thinning be highly satisfactory—as "Mount Vernon," "Rutter," "Kieffer's hybrid." Again, in some sections certain varieties are specially subject to disease, as blight, yellows, etc. Such varieties should usually be avoided as too uncertain for that locality, whereas they might be judiciously planted, under favorable conditions, elsewhere.

We should see a fair show of probabilities in favor of a new fruit before planting it, while with old fruits we should learn their history and peculiarities in the past, and not blindly follow on to

certain failure, where a different selection might be quite satisfactory.

An amateur garden should have the best management, fertilization, and culture; should embrace in varieties a selection of well-known, favorite kinds; and novelties should be introduced with about the same discretion as you would introduce a stranger into your family, viz.: to be sure of his probable good standing before a welcome.

A little more risk may be allowed in small fruits than in trees which require long years of growth before fruitage. Still, planters may reasonably exercise good discretion even here. The high qualities of new varieties are usually exaggerated; they nearly always have had extra care and culture, and as they reach common treatment prove to be less extraordinary. Thus, we hear of the Jersey Queen Strawberry reaching a weight of — ounces. Well, do not for one moment suppose that in a matted row, on poor soil, and with poor culture, you are going to get any such enormous fruit. We read of raspberries which reach three-quarters of an inch in diameter, and we have had them; *but this is the exception*, not the general size; therefore it is safe not to expect too much, even of a good variety.

He who has an inquiring mind, and will weigh well the merits and demerits of new varieties, may soon learn so as not to be very badly deceived in his selection of varieties for an amateur garden.

## WHAT OUR STATE HAS DONE, AND WHAT IT MAY DO IN ORIGINATING NEW VARIETIES OF FRUIT.

Our fathers, mothers, and sisters have had no lack of success in producing a large number of new varieties of fruit which have been so good as to be in the fruit books of Downing, Thomas, Warder, and other eminent pomologists.

More than one hundred varieties of fruits of merit have been described as of Connecticut origin, not less than twenty in the city of Elms, and the names of Edwards, Ives, Dickerman, Howell, Parmelee, and several others, will long be remembered, "their works (and their fruits) following them."

Hardly a town in the State has failed to produce some choice variety of fruit. On entering a hall in Suffield, to witness a horticultural exhibition in 1881, the most prominent dish was a

platter of peaches weighing twelve ounces each, which for rare size and beauty surpassed any thing I ever saw. I found upon inquiry that it was a seedling variety planted by a Miss Carrie Loomis, a young miss but just in her teens. I asked "are they as good as they look." "You shall try them yourself," was the answer. I did try and found them lacking in nothing that constitutes a peach of high merit. If hardiness, health, and productiveness be proved *Carrie's Champion* may be favorably known wherever peaches are grown.

Parmelee's Crescent seedling strawberry of New Haven has in some points won a world-wide reputation, and in wonderful hardiness and productiveness may well challenge every other variety.

The late Dr. J. J. Howe of Birmingham, was successful in producing, not only a pin machine, which now supplies every maiden in the world with those indispensable little articles, but he also originated several choice varieties of fruit, worthy of notice and cultivation. The last act of his life was the picking in his garden a beautiful specimen from one of his choice trees. As a man of modest worth and successful endeavor, we have but to say, his works they praise him.

There are many new varieties of fruit of the various classes and kinds, which in our State are now being tested, some of which will undoubtedly be heard from in the near future; it is worthy of note that many ladies are doing much in this direction, and with great promise of success. The love of fruits and flowers should certainly be encouraged in both sexes, and in this respect the future is full of promise. We confidently predict that a greater number of choice new fruits will be brought to notice during the last quarter of this century than in any corresponding period of the past.

## ORNAMENTAL STREET TREE-PLANTING.

The following act was passed and approved in 1881, by the Connecticut Legislature:—"Every person planting, protecting, and cultivating elm trees not more than sixty feet apart, or maple, tulip, ash, basswood, oak, black-walnut, or hickory, not more than thirty feet apart, for three years, for the space of one-quarter of a mile or more, along any public highway, shall be entitled to receive an annual bounty thereafter of one dollar for each quarter-mile so planted and cultivated, to be paid out of the State treasury; but

such bounty shall not be paid for more than ten years, or any longer than such line of trees is maintained." This bounty, though small, has had an effect to call attention to, and to stimulate street tree-planting. There is, however, a radical error in its well-meant sentiment, viz: in making the distance thirty feet instead of forty or fifty feet. It is not a dense hedge we like to see for street trees, but a line of grand, well-developed, symmetrical trees. The black walnut, or Norway maple, would, when mature, occupy double the specified distance. Prizes have been offered in several towns of our State for the best efforts in tree-planting, and we know that in many towns where no prizes have been offered a very commendable spirit has been shown in planting, by the highways, lines of beautiful trees; let the good work go on. Many a rough place may in this way be made very attractive. The great variety of trees which flourish in our climate offer abundant material at low cost to the lover of the beautiful. The planting of memorial trees should also be encouraged.

On the very day of the battle of Lexington, a bride from Windham, Conn., took, on a horse, lashed to the saddle behind her, three elms from her father's farm to her new home in Woodstock; there they stand to-day, a grand memorial of our national history, and represent also a prominent era in the life of the fair planter. And who can wonder that the descendants of that ancient couple look upon those trees of ancestral planting with honest pride?

### TIMBER-PLANTING ON CHEAP LAND.

A public act was passed a few years since, exempting from taxation land not assessed higher than $15 per acre, which shall have been planted with valuable kinds of timber-trees, specified in the act, for a period of ten years after the plantation be made. (As the act has already appeared in these reports it is not given here.)

We have in many sections of our State waste land, land which may be bought at from $2 to $10 per acre, land nearly valueless, which if producing anything it is only trashy kinds of wood which can be of no great value; such lands bought at their present value can be made a hundred-fold better by systematic planting with chestnut, ash, oak, pine, European larch, hickory, or such other valuable timber as the land may be suited for. We thereby make a permanent, valuable investment, desirable in itself and valuable also in its climatic influence.

As an instance to illustrate this point, let me cite a fact. Some forty-two years since a father in West Stafford, Conn., said to his five sons, "there is a sand waste of five acres. If you boys will plant that to white pine and take care of it you may have it;" the land at that time was as near worthless as land could be. Well those boys did plant it in rows some seven feet apart by eight feet in the row, and now that five acres has risen in value from nearly nothing to $80 per acre, or four hundred dollars for the tract. And those boys, Daniel, Alden, Spencer, David, and Noah Davis, look upon that *pine-timber* as of some value. We learn that the *Shaker Communities* of Enfield have treated some hundreds of acres in the same way, more recently.

Elder Pease of the North family of Shakers at Enfield, fully appreciates the importance of turning our waste land to good account, and has done as follows: he has taken 200 acres of their sandy plain, and year by year made sowings of seed of white pine, until he has a splendid young plantation of area aforesaid, stocky and vigorous, which will gratify his sight as long as he lives and be a monument to his memory when he is gone.

Elder Pease states that he has found the best way to be merely to sow the seed on the turf, and without greater pains a good catch will be the result; he says that it will invariably get a good start and do well when thus planted, no matter how hard the soil; the seed does best when sowed in early spring; as to gathering the seed, he says the squirrels gnaw off the cones in September, for their food in winter; he goes to the pine forest and gets those cones by the load, spreads them on some spare floor to lie till they open, and the seeds, by raking over the cones repeatedly, come out and may be swept up and put in bags for spring use.

It is not every year that the pines seed well, but when they do, the matter of saving and sowing the seed is easy and simple; in a good fruiting year the cones will be found under the pines quite thick, and it might be quite a pleasure to the young people to go on a coning excursion, and by an after-planting help to restore health and beauty to the old "Nutmeg State."

Mr. Daniel Davis, above mentioned, has recently bought a tract of some fifty acres in Tolland of "Shrub Oak," at $2.50 per acre, and after burning over, plants to timber, I think *White Ash*. The assessors have doubled the land in the list, but Mr. D. may soon exempt for ten years entirely, after which the plantation may be

expected in time to increase in value faster than money at interest. Why can not the sand plains of Connecticut be taken up and all be clothed with a beautiful growth of white pine? In the vicinity of a pine grove, young trees (six to eight inches the best size) can easily be found and planted late in May, with a loss of not more than ten per cent., the work can be easily and rapidly done, or the seeds may be gathered the last of September or the first of October, as the cones open about that time, and the seeds soon after are released.

In a growth of pine for timber, after the trees attain a height of twelve or fifteen feet, pruning may be done in this way: First, where young trees are throwing a heavy growth into lateral branches, promptly shorten in to throw a growth into the upward leading-shoot. At this age in the trees, one or two tiers of laterals may be taken off annually, not more than that at one trimming, and thus the stems gradually thrown upward for timber in after years.

For timber on land suitable, the chestnut is second in rapid growth and value to none.

The white ash is in large and increasing demand, at good prices; also the hickory. There are trees in our State of the black walnut, of rapid growth and large size. The butt of a single tree of the latter, now standing, has been estimated, if sound, which it appears to be, to be worth $80.

There is no reason why much of our cheap land should not be greatly enhanced in value by timber-planting.

## THE EXHIBIT AT THE WINTER MEETING OF THE BOARD OF AGRICULTURE AT ROCKVILLE, CONN.

Owing to the short apple crop in most parts of our State, our expectations were moderate in regard to the display upon the fruit tables at the winter meeting at Rockville; however the time came and also a large number of express packages from different parts of the State. containing fruit, grain, corn, honey, sorghum syrup, potatoes and other vegetables, making in all, in variety and extent, one of the best exhibits yet made.

There were on exhibit as follows:

From Sec. T. S. Gold of West Cornwall, a superb collection of some 35 varieties of apples, 6 of pears, 2 of squashes, and a bottle

of sorghum syrup; in the above collection we noticed as very prominent, beautiful specimens of the Excel apple, which originated in Sharon, Litchfield county, which for beauty and excellence is worthy of wide dissemination.

From Nathan Hart of West Cornwall, a collection of some 25 dishes of apples of great beauty and excellence.

P. M. Augur & Sons of Middlefield also had some 20 dishes of apples, among which were the Canada Red, Coe's Late Greening, and the Pewaukee, worthy the special attention of orchardists.

Hon. S. B. West of Columbia also had a collection of apples, among which were Brown's Favorite, a beautiful and delicious apple, and the Columbia Hyde, an apple of rare beauty, both of Columbia origin, and worthy of the attention of orchardists.

From. Col. Alexander Warner of Pomfret: a choice collection of several dishes of apples, among which was Jewett's Fine Red or Nodhead, which is not often exhibited in Connecticut. N. R. Grant of Rockville: a collection of choice apples; also a good sample of sorghum syrup. A. B. Davis of Ellington: choice apples. Capt. L. F. Scott of Bethlehem: choice apples, and specimen ears of corn. D. N. Van Hoosear of Wilton: apples, stalks and ears of different varieties of wheat; also the Soya bean. E. S. Henry of Rockville: a basket of beautiful and excellent Hollow Crown apples, much admired and appreciated. R. H. Van Deusen: Hybridized onions, Shaker Station. N. S. Platt, Esq., Cheshire: excellent specimen bunches of the Jefferson grape, well kept and delicious. T. S. Hubbard of Fredonia, N. Y.: several choice clusters of the Prentiss grape, in excellent condition.

From Col. Alexander Warner of Pomfret: a collection of several varieties of potatoes, of large size and fine appearance. Chas. A. Dudley of Guilford: samples of choice spring wheat and spring rye, very tastefully put up, and of fine quality, with an accompanying statement of yield, etc. A. M. Bailey of Middlefield: ears of improved white corn. James O. Ross, Middlefield: Longfellow corn, and a very handsome white corn. T. S. Gold, West Cornwall: several varieties of field corn, all excellent, and adapted to New England culture. Nathan Hart of West Cornwall: several choice varieties of field corn. L. F. Scott of Bethlehem: choice field corn. Harvey E. Buell, Clinton: a large collection of field corn, planted in July, well matured and of good

appearance. W. H. Olmstead, East Hartford: field corn. W. C. Hart of West Cornwall: a long-eared yellow corn, similar to that of Nathan Hart and T. S. Gold, early and productive. N. S. Platt of Cheshire: Long-John corn, seed from Georgia, a late white corn. Theron E. Platt, Stone-edge Farm, Newtown: corn and grain.

FROM GREEN'S FARMS FARMERS' CLUB.

By Wm. J. Jennings: yellow Dent corn, white Dent corn, four varieties sweet corn, one variety spring wheat, one variety rye, one variety oats, one mammoth sunflower, one dish black walnuts, one dish Southport red globe onions.

By T. B. Wakeman: white onions, red onions, white onion seed, red onion seed, yellow Dent corn, oats, buckwheat, Clawson wheat, and choice Burbank potatoes. By J. Elwood: Baker apples, Chester county mammoth corn, Magnum-Bonum potatoes. N. H. Sherwood: very large, fine carrots, and large yellow onions. H. B. Wakeman: Baldwin apples, black apples, yellow Dent corn, fine white onions, and Clawson wheat. D. H. Sherwood: fine carrots and potatoes. Austin Jennings: Burbank potatoes, good; fine yellow, red, and white onions, and fine specimen ears of white corn. S. B. Sherwood: Corn grown from seed of Agricultural Department, Dent corn, white flint corn, pop corn, red and yellow onions, Clawson wheat, oats and rye; all good. George Hale: choice wheat and white corn.

This was the second general display this club has made at the winter meetings of the Board of Agriculture—the previous one at Newtown, and this at Rockville—both reflecting great credit upon the agriculture of Green's Farms, which may truly be called "The garden of the State."

There was also exhibited, by Phineas Stedman of Chicopee, Mass., dairy apparatus, viz.: Moseley's cabinet creamery and the barrel churn, which attracted much attention. L. H. Reed, of Tolland, the Davis swing churn and the Cooley creamer; both well tried and well known in dairy circles.

The American Mills, of Rockville, exhibited horse-blankets at $4.25 each to members of the meeting, which were as good as $6 would purchase elsewhere.

From Mr. Myrick, of the N. E. Homestead, a sample of the new, much talked-of Sumatra tobacco. Also, from J. C. Ham-

mond of Rockville, a device for fastening arctics, etc., which was simple, convenient, and durable; worthy of general introduction and use. Wm. R. Phillips, Milford, Del.: a case of evaporated apples and peaches, dried in the Phillips Evaporator, of which he is patentee and proprietor, which claims to have a capacity, under the same conditions, of doing over one-fifth more work in the same time than the Williams, as per report of committee at Vashell & Jerman's, Smyrna, Del., August 31, 1882, where both were by mutual arrangement on trial.

There were some fifteen samples of sorghum syrup, from different growers in Bolton, Columbia, and elsewhere, which attracted much attention; and it is worthy of note that most of the growers feel satisfied with the results, and will continue its production hereafter.

There were exhibited and distributed some 260 packages of grape-seeds, all from dishes of premium grapes, mostly from the Connecticut State Fair at Meriden. These seeds are scattered all the way from Maine to Georgia, many of them going into the hands of ladies, who promise to plant and grow them and report the results of their experience. It is hoped that from these seeds some varieties of choice grapes may be originated which shall be superior to any we now have.

[NOTE.—Owing to the occasional displacement of cards by frequent handling of visitors, possibly some mistakes may occur in the report of the exhibits—which may explain, in case any article is overlooked or miscredited. P. M. A.]

### STRAWBERRY SHOW AT HARTFORD, JUNE, 1882.

In accordance with an invitation, there was an exhibit of strawberries at room No. 50, State House, Hartford. A very large collection of strawberries—thirty-seven varieties—was brought by G. H. and J. H. Hale, of South Glastonbury, embracing old and new varieties; including the Manchester among the new, and Hovey's Seedling among the old varieties. The collection was very fine, and admired by all.

P. M. Augur & Sons had a collection of a large number of varieties, including Finch's Prolific, Jersey Queen, and several new seedlings never before exhibited. These seedlings are from ounce berries of the Jersey Queen, fertilized with the Late Prolific—

both varieties originated by E. W. Durand, of Irvington, N. J. Of these seedlings Nos. 13, 19, 24, 48, 68, 78, 118, and 122 all promise unusually well.

Mr. Olcott, of the *Courant*, brought from his grounds in South Manchester a crate of berries wonderfully fine in appearance, and dealers say that customers are always satisfied with the high quality of Mr. Olcott's strawberries.

Mrs. Fairclough of Wolcott had a dish of monster Black Defiance strawberries, much admired.

Col. Dewey of Hartford, as usual, showed very fine specimens of different varieties of strawberries.

Mrs. M. G. Wells, a lady of Wethersfield, showed some beautiful roses. Also, Mr. R. Moore of Kensington, had a choice collection of roses, handsomely arranged, and excellent of their several varieties.

Secretary T. S. Gold of West Cornwall, showed some fine English russet apples, well kept.

Exhibitions of fruit at the autumn fairs at Meriden and elsewhere that I visited were generally good, although apples and pears were less plentiful than usual, and peaches shown only in one or two instances. Grapes, however, were well ripened and excellent, even the later kinds.

Our State, county, and town fairs are schools for all visitors, and all who attend should make a point to learn all they can.

I close with a suggestion or two concerning the arrangement at exhibitions. Candy-stands and glass-blowers, and various other arrangements, often occupy so much room in exhibition halls that exhibitors of fruits and vegetables are crowded into small space or into dark passageways, so that *the agricultural part* is only the tail of the exhibit, so to speak. This ought not so to be. Again, the importance of grouping the fruits and vegetables in appropriate classes. For example: let the Early Rose potato, the Hubbard squash, the Bartlett pear, the Baldwin apple, the Concord grape or the Orange quince—no matter how many dishes of either kind—be arranged, when not shown as a single collection, in groups of their own. This facilitates inspection by judges and visitors.

Respectfully,

P. M. AUGUR,

*Pomologist.*

## REPORT OF THE COMMISSIONERS ON DISEASES OF DOMESTIC ANIMALS.

The past year has been one of general health among our flocks and herds. They have been exempt generally from any contagious disease. But this has not occurred from pure accident. The knowledge of our breeders and dealers of the nature of these diseases due in some degree to the work of the Commission, has been a large element in this exemption, to which must be added the work of the Commission in the past in eradicating disease, and watchfulness continually against its introduction from abroad. In fact, aside from the frequent calls upon your Commission in cases of common ailments of animals not considered contagious, the work of the Commission has been almost entirely confined to the latter, guarding against the introduction of pleuro-pneumonia from the adjoining infected district in the State of New York, and because successful may be considered of little account. But this supposition cannot be sustained. Especially has this work become both more difficult and more necessary since the State of New York has released its efforts to stamp out the disease, and it has reappeared in many of its old haunts, and even has spread into new localities. It has recently broken out in Dutchess Co., adding further proof, if any was necessary, against any cattle traffic in animals to be carried from the infected district. It is a well established fact that the sales stables of New York are more or less infected with contagious pleuro-pneumonia; no cattle that have been in them, or that have been transported in the ordinary way, or even that go out of the infected district are safe against contagion, and should be subjected to a quarantine of at least ninety days.

How any sane man, with the experience of the past, will take the personal risk on the animals, and the wholesale danger involved, and take any neat stock from any part of the infected district on to his own farm or for sale outside, is only explained by the phrases, "know nothing, fear nothing," or "experience is a dear school and fools will learn in no other."

The poor fellows that in the vicinity of New York purchase a cow of the dealer, with privilege of exchange if she does not suit, find themselves entangled in a net-work that they cannot unwind. The cow is taken sick and returned to keep up the infected condi-

tion of the dealer's stable. Another one may be taken in exchange with the same result, and with ignorance, indifference, and rascality, the difficulty of eradicating the plague is almost unsurmountable.

A bill is now pending in the United States Senate, having passed the House of Representatives, appropriating fifty thousand dollars to the treasury department for the purpose of investigating the extent of the disease in this country, and the means for its suppression. This will make a good beginning, but it is estimated that a sum of two millions will be required to effectually stamp out the disease from the infected district, which now extends from the vicinity of New York city as far South as Maryland, a sum that is annually now lost to the country, in the restrictions put upon the cattle trade with that country by Great Britain, as compared with the free trade of Canada, solely based upon the existence of contagious pleuro-pneumonia in the United States.

A new feature of danger has also recently developed, from the increased dairy business of the West. In addition to the shipment of choice blood stock to the West—a class that is always scrupulously guarded from infection, but as past experience has shown, not always efficiently—a new trade has sprung up in calves and yearlings. Large numbers have been shipped from Ohio, western New York, and Vermont, and though not acknowledged, from the infected district of the seaboard.

The small profit to a few individuals in this trade, compared with the great risks, is so insignificant that it should not be tolerated at all. The action of Congress should be prompt and decisive. Within the estimated cost of two millions now, it may soon be five, or even beyond control. While Connecticut should retain the present efficient law for self-protection, the power of the National government is needed to stamp it out where it now exists, and to prevent it from spreading through the cattle States of the West. And it is but fair that the National treasury should also furnish the means to accomplish the work. All the states have a common interest in the matter, and some of them a much greater interest than those States in which the disease now exists.

As contagious pleuro-pneunomia exists in some of the European states, the treasury department of the United States very properly exercises its authority in quarantining for ninety days all imported neat stock. To facilitate this object quarantine grounds are established near Boston, New York, and Baltimore. These yards are

but just completed, and hitherto animals imported by breeders in this State have been allowed to come here under the National quarantine regulations, in charge of your Commission. Over forty head of choice high-priced Jerseys have recently been imported by Messrs. S. M. Burnham of Saugatuck, W. R. McCready of Saugatuck, S. W. Robbins of Wethersfield, Wallace Barnes of Bristol, and ten head of Swiss by Messrs. Scott and Harris of Wethersfield. All these have served their ninety days of quarantine, till released by the commission, except two herds that are still in our care.

This privilege has been a great accommodation to the owners who desired to have their animals under their own supervision, but has imposed considerable labor on the Commission to attend faithfully to the surveillance of the animals placed in our charge. These importers are all very anxious for the continuance of this privilege, feeling that the quarantine in the public yards is a great burden upon their efforts to improve our neat stock, and it has been very gratifying to us that we could be of such essential service to them. All cattle that are permitted by the New York Cattle Commission to come to this State, are promptly reported to this Commission.

The action of the last Legislature in abolishing the law for the suppression of glanders, and failure to enact a more efficient one, has left the matter as it stood before, to be dealt with by Boards of Health, the Humane Society, and this Commission; not, it is true, in a very efficient or satisfactory manner, yet the necessity for action has been so often made apparent that none of these organizations could refuse to take such action as their powers allowed. Many bad cases have thus been disposed of, but no thorough work looking to its extermination has been attempted. The continued existence of the disease in any civilized community is proof enough of the dangerous nature of the malady, and the difficulty of eradicating it. When the State demands in the exercise of its paternal authority that every danger to the lives of its citizens, and to their material prosperity shall be scrupulously guarded against by law, then we may hope to have some legislation that will protect us from this which has always been a most fatal malady among horses, and fraught with danger to the human family.

E. H. HYDE,<br>T. S. GOLD,<br>J. W. ALSOP, } *Commissioners on Diseases of Domestic Animals.*

HARTFORD, Feb. 13, 1883.

## OFFICIAL LIST OF AGRICULTURAL SOCIETIES IN CONNECTICUT, 1882–83.

| Name of Society. | President. | Secretary. | Treasurer. |
|---|---|---|---|
| Connecticut State, | James A. Bill, Lyme, | H. C. Hull, Meriden, | William H. Gross. |
| Hartford County,* | J. C. Capen, Bloomfield, | Warren Rowley, Hartford, | William H. Gross. |
| New Haven County,* | D. N. Clark, Woodbridge, | C. P. Augur, Whitneyville, | Frank S. Platt. |
| New London County, | H. W. Kingsley, Franklin, | Joab B. Rogers, Norwich, | F. L. Gardner. |
| Fairfield County, | J. E. Wheeler, Saugatuck, | Henry T. Shelton, Bridgeport, | William A. Curtiss. |
| Windham County, | Gurdon Cady, Central Village, | Theo. C. Pond, Brooklyn, | Thomas J. Evans. |
| Litchfield County,* | Harry Sedgwick, Cornwall Holl'w, | D. C. Kilbourn, Litchfield, | E. C. Jones. |
| Middlesex County,* | J. M. Hubbard, Middletown, | G. W. Wilson, Middletown, | G. W. Wilson. |
| Tolland County, | Charles W. Lee, Coventry, | F. R. Tucker, Rockville, | Charles Phelps. |
| Bloomfield,* | H. G. Fish, Bloomfield, | J. E. Cox, Bloomfield, | H. W. Rowley. |
| Chester, | J. E. Silliman, Chester, | E. G. Smith, Chester, | E. G. Smith. |
| Clinton, | G. E. Elliot, Clinton, | G. H. Brooks, Clinton, | E. E. Post. |
| Danbury, | J. W. Bacon, Danbury, | B. C. Lynes, Danbury, | J. W. Bacon. |
| East Granby,* | C. H. Hanchett, East Granby, | H. L. Clark, East Granby, | J. W. Thompson. |
| Guilford, | Arthur S. Fowler, Guilford, | J. Seymour Benton, Guilford, | George B. Spencer. |
| Harwinton, | C. T. Russell, Harwinton, | Addison Webster, Harwinton, | Addison Webster, |
| Killingworth,† | L. L. Nettleton, Killingworth, | F. Turner, Killingworth, | F. Turner. |
| Meriden, | W. J. Ives, Meriden, | L. E. Coe, Meriden, | L. H. W. Yale. |
| Milford and Orange, | A. N. Clark, Milford, | E. G. Miles, Milford, | Charles F. Smith. |
| New Milford, | J. LeRoy Buck, New Milford, | F. W. Marsh, New Milford, | Charles Randall. |
| Oxford, | Wooster B. McEwen, Oxford, | William W. Hughes, Oxford, | E. B. Treat. |
| Pequabuck, | G. P. Bennett, Bristol, | G. A. Gowdy, Bristol, | G. A. Gowdy. |
| Ridgefield,* | E. H. Smith, Ridgefield, | E. L. Smith, Ridgefield, | D. Smith Sholes. |
| Simsbury, | E. A. Hoskins, Simsbury, | Phelps Tuller, Simsbury, | Phelps Tuller. |
| Southington, | Enos E. Stow, Plantsville, | William H. Cummings, Milldale, | Wm. H. Cummings. |
| Suffield, | M. J. Sheldon, Suffield, | H. F. Fuller, Suffield, | H. F. Fuller. |
| Tolland County, East, | W. Holman, Tolland, | R. S. Hicks, Stafford Springs, | R. S. Hicks. |
| Torrington,* | E. T. Weston, Torrington, | C. James, Torrington, | C. James. |
| Union (Falls Village), | M. H. Robbins, Lakeville, | M. U. Dean, Huntsville, | O. M. Brinton. |
| Union (Somers, etc.), | Henry Abbe, Enfield, | J. T. McKnight, Ellington, | Charles M. Abbe. |
| Union (Monroe, etc.), | Henry S Wells, Birmingham, | J. Tomlinson, Birmingham, | S. H. Blackman. |
| Waterbury,* | Samuel Root, Waterbury, | C. N. Hall, Waterbury, | G. S. Parsons. |
| Watertown, | William G. French, Watertown, | Alanson Warren, Watertown, | H. M. Hickox. |
| Westbrook, | R. H. Stannard, Westbrook, | G. A. Post, Westbrook, | T. D. Post. |
| Woodbridge and Bethany, | T. A. Todd, Woodbridge, | S. G. Davidson, Bethany, | S. G. Davidson. |
| Woodbury, | G. I. Barnes, Woodbury, | W. E. Scovill, Woodbury, | G. P. Crane. |
| Woodstock, | M. F. Towne, Thompson, | W. I. Bartholomew, Putnam, | E. T. Warner. |

* No Fair. † No Premiums.

## RETURNS OF AGRICULTURAL SOCIETIES, 1882.—FINANCES—RECEIPTS.

| SOCIETIES. | Cash on Hand. | Single Admission Tickets. | Membership or Season Tickets. | Grand Stand. | Donations and Unclaimed Premiums. | Entrance Fees, Trials of Speed. | Other Entrance Fees. | Rent of Grounds. | State Appropriation. | Other Sources. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Connecticut State | $3,738.37 | $2,566.51 | $788.25 | ........ | ....... | $510.00 | $21.00 | ........ | $2,500.00 | 760.98 | $10,885.11 |
| New London County | ........ | 1,994.91 | 161.00 | $130.00 | $6.00 | 550.00 | 49.25 | $542.60 | *310.85 | ........ | 3,433 76 |
| Fairfield County | ........ | 600.68 | ..... | 412.00 | 23.00 | 825 00 | 76 00 | 1,618.60 | 487.53[1] | $16.00[2] | 6,538.51 |
| Windham County | 133.84 | 812.66 | 812.66 | 23.00 | 9.75 | 162 50 | 15.00 | 362.50 | 313.18 | 33.00[3] | 1,552.25 |
| Tolland County | ........ | 135.79 | 112.72 | 10.15 | ........ | ........ | ........ | 50.00 | 141.88 | ........ | 308.66 |
| Chester | 20.77 | 61.59 | 14 50 | ........ | 5.50 | ........ | ........ | 4.00 | 103.14 | ........ | 106.27 |
| Clinton | 209 06 | 119.25 | 79.00 | ........ | 2.55 | ........ | 5.50 | 5.00 | 145.10 | 113.82[4] | 534.18 |
| Danbury | 2,127.11 | 7,956.03 | ........ | 1,003.85 | ........ | 740.00 | 12.50 | 1,533.30 | 631.43 | 60.60[5] | 13,433.39 |
| Guilford | 20.75 | 93.00 | 62.50 | ........ | 120.00 | ........ | ........ | ........ | 139.69 | ........ | 296.25 |
| Harwinton | 19.33 | ........ | 1.75 | ........ | 20.75 | ........ | ........ | 403.50 | 132 68 | ........ | 418.65 |
| Milford and Orange | 10.65 | 354 00 | 50.00 | 62.00 | ........ | 160.00 | 14.00 | 100.00 | 126.76 | 70.00 | 917.41 |
| New Milford | 07 | 1,087.88 | ........ | 57.27 | ........ | 380 00 | ........ | 128.50 | 219.37 | 276.45[6] | 1,930.17 |
| Pequabuck | 218.44 | 611.60 | 611.60 | ........ | 35.00 | 20.00 | ........ | 110.00 | 166.97 | 250.00[7] | 1,245 04 |
| Simsbury | 208.43 | 404.34 | 50.00 | ........ | ........ | 67.50 | ........ | 38.00 | 133.59 | ........ | 768.27 |
| Southington | ........ | 1,272.00 | 216.00 | 221.00 | ........ | 346.00 | 30.00 | 224 00 | 201.08 | 202.00 | 2,511 00 |
| Suffield | 19.15 | 288.06 | 22.00 | ........ | 19.50 | 99.50 | ........ | 72.27 | 112.42 | 46.63 | 567.11 |
| Tolland County East | ........ | 1,708.74 | 119.53 | 107.61 | ........ | 441.00 | ........ | 132.50 | 203 54 | 71.25 | 2,579.56 |
| Union (Falls Village) | 171.75 | 289.25 | ........ | 13.97 | 124.00 | 200 00 | ........ | 136 00 | 138.42 | ........ | 934 97 |
| Union (Somers, etc.) | 41.34 | ........ | 9 00 | ........ | 65.65 | ........ | ........ | 5.00 | 109.81 | ........ | 120.99 |
| Union (Monroe, etc.) | 17.57 | 433.88 | 188.00 | 7 90 | 37 25 | 60.00 | 29 50 | 36.50 | 203.55 | 513.87[8] | 1,324.47 |
| Watertown | 46.26 | 1,036.60 | 262.00 | 26.85 | ........ | 420.00 | 26.00 | 661.75 | 268.72 | ........ | 2,478.44 |
| Westbrook | 144.10 | 159.68 | 130.00 | ........ | 25.60 | ........ | ........ | ........ | 160.30 | 116.22 | 575.60 |
| Woodbridge and Bethany | ........ | 60.74 | 78 00 | ........ | ........ | ........ | 10.00 | 50.00 | 158.43 | 1.00 | 199.74 |
| Woodbury | 28.13 | 123.66 | 62 00 | ........ | ........ | 34.00 | ........ | ........ | 101.17 | ........ | 247.79 |
| Woodstock | 23.44 | 1,059.79 | 1,059.79 | 53.36 | ........ | 36 00 | 40 00 | 190.00 | 274.14 | 136.50[9] | 1,539.09 |

[1] $200 for 1881. [2] Sale of hay, oats, etc. [3] Horse stalls and grass on grounds. [4] Advertisements in Premium Lists, $103.57—Special Premiums offered, $10.25. [5] Interest. [6] Pasture, $15—Rebate on Freight, $145—Bills Payable, $260. [7] Borrowed money. [8] Advertising, $89.25—Borrowed, $300.00—Owe, $124.62. [9] Grass sold, $92.00—Advertisements in Premium Lists, $44.50.

* This column is added by me and not included in footings, except $200 in Fairfield County, for 1881.—T. S. G.

## RETURNS OF AGRICULTURAL SOCIETIES, 1882.—FINANCES, CONTINUED.

| SOCIETIES. | Expenses of Fair. | Premiums for Speed and Amusements. | Other Premiums and Gratuities. | Permanent Improvements. | Other Expenses. | Cash on hand. | Total. | Indebtedness of Society. | Real Estate. | Personal Estate. | Number of Members. | No. of Stockholders—Joint St'k. | Capital Stock. | Estimated Attendance. | Admission Tickets. | Season Tickets. | Grand Stand. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connecticut State | $2,989.44 | $710.00 | $3,575.00 | ........ | $400.00 | $3,610.67 | 10,885.11 | ........ | ........ | ........ | ..... | .... | ........ | [2] 7,125 | .... | ... | ... |
| New London County | 1,032.07 | 750.00 | 905.75 | $252.82 | 459.00 | ........ | ........ | $5,700 00 | $10,000.00 | $400.00 | 311 | .... | [5] ........ | [3] 5,850 | $ .35 | ... | ... |
| Fairfield County | 2,203.29 | 1,685.00 | 947.25 | ........ | [4]1,265.25 | 437.72 | 6,538.51 | 10,250.00 | 21,401.04 | ........ | ..... | 160 | $30,000.00 | [6] 11,000 | .25 | ... | $.25 |
| Windham County | 262.97 | 325.00 | 1,002.00 | 53.01 | [7]177.93 | ....... | 1,820.91 | 268.66 | 4,500.00 | ........ | 372 | .... | ........ | [8] 3,100 | .25 | ... | .10 |
| Tolland County | 220.40 | ........ | 255.35 | ........ | ........ | ........ | .. .... | 1,000.00 | 2,500.00 | 30.00 | 230 | .... | ....... | [9] 1,500 | .25 | $.50 | .10 |
| Chester | 52.50 | ........ | 111.65 | 14.37 | ........ | ........ | ........ | ... .... | ....... | 110.10 | 64 | .... | ........ | 700 | .10 | ... | ... |
| Clinton | 130.70 | ....... | 267.35 | ........ | ........ | 136.13 | 534.18 | ... .... | ........ | 70.00 | 158 | .... | ........ | 1,350 | .10 | ... | ... |
| Danbury | 3,406.79 | 2,010.00 | 2,071.60 | 315.97 | ........ | 5,629.03 | 13,433.39 | ........ | 10,000.00 | 2,000.00 | . ... | 190 | 8,000.00 | [10] 33,369 | .25 | ... | .25 |
| Guilford | 81.75 | .... ... | 247.25 | 60.00 | ........ | ........ | ........ | ........ | ....... | 610.00 | 127 | .... | ........ | 300 | .10 | ... | ... |
| Harwinton | 303.60 | 1.50 | 221.25 | ........ | ........ | ........ | ........ | ........ | ........ | 368.45 | 81 | .... | ....... | ....... | .... | ... | ... |
| Milford and Orange | 290.81 | 350.00 | 199.24 | ........ | 233.00 | .... ... | 1,073.05 | 252.40 | 500 00 | 500.00 | 35 | .... | ........ | [11] 1,500 | .25 | 1.00 | .15 |
| New Milford | 557.39 | 648.00 | 553.90 | ........ | [12]145.00 | 25.88 | 1,930.17 | 2,831.85 | 10,489.78 | 503.28 | ..... | 151 | 7,957.50 | [13] 4,351 | .25 | ... | .15 |
| Pequabuck | 187.40 | 100.00 | 348.50 | 542.43 | 22.00 | 44.71 | 1,245.04 | ........ | ....... | .... ... | ..... | .... | ....... | ........ | .... | ... | ... |
| Simsbury | 125.00 | 187.50 | 224.59 | 65.00 | ........ | 166.18 | 768.27 | ........ | ........ | ........ | 169 | .... | ........ | ........ | .... | ... | ... |
| Southington | 525.75 | 820.00 | 486.25 | 6,875.00 | [14]269.00 | ........ | ........ | ........ | 6,800 00 | 200.00 | ..... | 97 | 7,000.00 | [15] 4,500 | [1].25, .50 | 1.00 | .25 |
| Suffield | 96.77 | 232.00 | 157.25 | ........ | 36.38 | [16]15.56 | 547.96 | ........ | ........ | ....... | 23 | .... | ........ | [17] 1,250 | .... | ... | ... |
| Tolland County East | 852.78 | 845.00 | 487.25 | 475.10 | 67.50 | ........ | 2,727.63 | ... .... | 2,500.00 | 500.00 | ..... | .... | ........ | [18] 8,500 | .25 | ... | .10 |
| Union (Falls Village) | 90.47 | 675.00 | 200.00 | 69.50 | ....... | ........ | 1,034.97 | 523.76 | ........ | 475.00 | ..... | .... | .... ... | [19] 1,520 | .25 | ... | .10 |
| Union (Somers, etc.) | 27.00 | 136 35 | ...... .. | ........ | ........ | ........ | ........ | ........ | ... .... | 1,000.00 | 336 | .... | ........ | 2,500 | .... | ... | ... |
| Union (Monroe, etc.) | 508.91 | 233.00 | 484.25 | ........ | [20]96.31 | ........ | 1,324.47 | 1,000.00 | 2,500.00 | 100 00 | 275 | .... | ....... | [21] 700 | .25 | 1.00 | .15 |
| Watertown | 884.97 | 970.00 | 623.25 | ........ | ........ | 22 | 2,478.44 | ........ | ........ | ........ | 263 | .. | ........ | [22] 2,650 | .50 | ... | ... |
| Westbrook | 238.21 | ........ | 302 15 | ........ | [23] | 9.64 | 575.60 | ........ | ........ | ........ | 260 | .... | ........ | 2,500 | .10 | .50 | ... |
| Woodbridge and Bethany | ........ | ........ | 316.50 | ........ | 25.60 | ........ | ........ | ........ | ........ | ........ | ..... | ... | ........ | ....... | .25 | 1.00 | ... |
| Woodbury | 165.00 | 125.00 | 104 35 | ........ | .... ... | ........ | ........ | ........ | ........ | ........ | 62 | ... | ........ | ....... | .25 | ... | ... |
| Woodstock | 572.57 | 131.00 | 746.07 | ...... | ........ | 89.45 | 1,539.09 | 300.00 | 5,725.00 | 35.00 | 330 | .... | ........ | [24] 3,500 | .25 | .75 | .15 |

[1] To Hall, $0.25; To Park and Hall, $0.50. [2] Tuesday, 1,700, Wednesday, 4,200, Thursday, 650, Friday, 575. [3] Tuesday, 550, Wednesday, 3,500, Thursday, 1,800. [4] Loans, $600; Interest, $570; Insurance, $95.25. [5] Unsold and uncalled stock, $24,020. [6] Tuesday, 500, Wednesday, 500, Thursday, 6,000, Friday, 4,000. [7] Ins., $32.00, Sal. of Treas., $75, Cor. Sec., $10, Rec. Sec., $30, Sundries, $30.93. [8] Tuesday, 600, Wednesday, 800, Thursday, 200, Friday, 1,500. [9] Friday, Stormy, Saturday, 1,500. [10] Monday, 500, Tuesday, 1,000, Wednesday, 3,627, Thursday, 13,760, Friday, 8,810, Saturday, 5,672. [11] Tuesday, 1,000, Wednesday, 500. [12] Interest. [13] Wednesday, 400, Thursday, 900, Friday, 800, Saturday, 2,251. [14] Dis., $75, Road mach., $68, Printing, $85, Ins. $16, Fees, Nat. Trot. Ass., $25. [15] Monday, 1,500, Tuesday, postponed, Wednesday, 2,000, Thursday, 1,000. [16] Premium donated to Society, $10. [17] Wednesday, 250, Thursday, 1,000. [18] Thursday, 1,500, Friday, 7,000. [19] Tuesday, 200, Wednesday, 720, Thursday, 600. [20] Interest, $38, Nat. Trot. Ass., $25, Old bills, $33.31. [21] Wednesday, 450, Thursday, 250. [22] Tuesday, 450, Wednesday, 1,000, Thursday, 1,200. [23] Donation out, $25.60. [24] Wednesday, 2,000, Thursday, 1,500.

# NUMBER OF ANIMALS EXHIBITED.

| SOCIETIES. | Bulls. | Milch Cows. | Heifers. | Calves. | Working Oxen (pairs). | Steers (pairs). | Fat Cattle. | Horses—except speed. | Horses—speed. | Sheep. | Swine. | Poultry (coops). | All other Stock. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connecticut State | 39 | 84 | 89 | 64 | 28 | 16 | 14 | 82 | .. | 231 | 15 | 202 | .. |
| New London County | 18 | 77 | 64 | 20 | .. | 11 | 8 | .. | .. | 43 | 12 | .. | .. |
| Fairfield County | 21 | 9 | 10 | 8 | 15 | 6 | 1 | 29 | .. | 7 | 8 | 153 | .. |
| Windham County | 13 | 3 | 57 | 31 | 9 | 40 | 7 | 48 | 15 | 138 | 26 | 48 | 151 |
| Tolland County | 2 | 3 | 1 | 4 | 2 | 5 | 3 | 11 | .. | 1 | 1 | 26 | .. |
| Chester | 3 | 3 | 7 | .. | 40 | 13 | .. | 8 | .. | 1 pen. | .. | 5 | 3 |
| Clinton | 10 | 17 | 7 | 9 | 37 | 2 | 3 | 16 | .. | 133 | 57 | 54 | .. |
| Danbury | 22 | 28 | 30 | 10 | 76 | 12 | 6 | 46 | 37 | 34 | 12 | 180 | 40 |
| Guilford | .. | 9 | 2 | 6 | 102 | .. | 5 | 21 | .. | 27 | 65 | 31 | .. |
| Harwinton | .. | .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. |
| Milford and Orange | 3 | 5 | 3 | 3 | 9 | 12 | 4 | 16 | 23 | 8 | 2 | 10 | .. |
| New Milford | 17 | 45 | 26 | 16 | 100 | 7 | .. | 91 | .. | 35 | 12 | .. | .. |
| Pequabuck | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Simsbury | 15 | 25 | 15 | 10 | 75 | 15 | .. | 25 | .. | 8 | .. | 10 | .. |
| Southington | 13 | 35 | 26 | 9 | 22 | 5 | .. | 18 | .. | 7 | 14 | 98 | 60 |
| Suffield | 6 | 18 | 11 | 7 | 23 | 7 | 1 | 21 | .. | 13 | 5 | .. | .. |
| Tolland County, East | .. | .. | .. | .. | 100 | .. | .. | .. | .. | .. | .. | .. | .. |
| Union (Falls Village) | 4 | 11 | 4 | 2 | 11 | 4 | 5 | 29 | 13 | 18 | .. | 1 | 13 |
| Union (Somers, etc.) | 6 | 19 | 13 | 10 | 25 | 12 | .. | 27 | .. | 6 | 2 | 1 | .. |
| Union (Monroe, etc.) | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Watertown | 7 | 32 | 11 | 5 | 100 | 90 | 2 | 50 | 20 | 78 | 13 | .. | 40 |
| Westbrook | 14 | 28 | 14 | 18 | 50 | 24 | 4 | 30 | .. | 126 | 37 | 59 | 11 |
| Woodbridge and Bethany | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Woodbury | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Woodstock | 9 | 49 | 35 | 18 | 37 | 27 | .. | 75 | 12 | 20 | 9 | 90 | .. |

# ANALYSIS OF PREMIUMS AND GRATUITIES PAID.

## FARM STOCK.

| SOCIETIES. | Bulls. | Milch Cows. | Heifers. | Calves. | Working Oxen. | Steers. | Fat Cattle. | Horses—except speed. | Horses—speed. | Sheep. | Swine. | Poultry. | All other Stock. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connecticut State | $326.00 | $435.00 | $130.00 | $104.00 | $200.00 | $88.00 | $31.00 | $277.00 | $710.00 | $253.50 | $20.00 | $159.50 | $1.00 | $2,028.00 |
| New London County | 47.75 | 132.75 | 62.75 | 18.00 | 47.00 | 22.50 | 11.00 | 245.50 | 731.00 | 94.85 | 29.50 | 13.50 | ........ | 1,456.00 |
| Fairfield County | 17.00 | 13.00 | 34.00 | 5.00 | 71.00 | 29.00 | 10.00 | 79.00 | 1,510.00 | 15.00 | 16.00 | 71.50 | ........ | 1,870.50 |
| Windham County | 67.00 | 9.00 | 45.00 | 18.00 | 64.00 | 26.00 | 14.00 | 151.00 | 325.00 | 48.00 | 30.00 | 66.50 | 108.00 | 971.50 |
| Tolland County | 5.00 | 8.00 | 1.00 | 3.00 | 8.00 | 9.00 | 3.00 | 20.00 | ........ | 3.00 | 1.00 | 19.50 | 18.00 | 98.50 |
| Chester | 1.00 | 1.50 | 2.50 | ........ | 6.50 | 1.00 | ........ | 6.50 | ........ | .50 | ........ | 2.25 | 7.00 | 22.75 |
| Clinton | 7.50 | 12.00 | 4.50 | 9.50 | 20.50 | 2.00 | 2.50 | 14.50 | ........ | 44.00 | 13.00 | 15.75 | ........ | ........ |
| Danbury | 51.00 | 60.00 | 40.00 | 5.00 | 144.00 | 25.00 | 9.00 | 119.00 | 1,805.00 | 22.00 | 33.00 | 125.00 | 28.50 | 2,465.50 |
| Guilford | ........ | 4.00 | 1.00 | 3.00 | 23.00 | 8.00 | 4.00 | 25.00 | ........ | 3.00 | 10.00 | 9.25 | ........ | 90.25 |
| Harwinton | ........ | ........ | ........ | ........ | ........ | ........ | ........ | 6.00 | ........ | ........ | 2.50 | 2.00 | 32.50 | 43.00 |
| Milford and Orange | 8.00 | 5.00 | 9.00 | 1.50 | 13.00 | 11.00 | 1.00 | 25.00 | 350.00 | 2.00 | 6.00 | .50 | ........ | 426.00 |
| New Milford | 14.00 | 87.50 | 8.00 | 17.00 | 120.00 | 7.00 | ........ | 48.00 | 648.00 | 13.50 | 3.00 | 50.00 | 5.00 | 1,021.50 |
| Pequabuck | 35.00 | 36.00 | 19.00 | 13.00 | 108.00 | 10.00 | 5.00 | 22.00 | 100.00 | 11.00 | 8.00 | 32.00 | ........ | 399.00 |
| Simsbury | 23.00 | 28.00 | 22.75 | 3.00 | 50.00 | 21.50 | ........ | 12.00 | 187.50 | 10.00 | ........ | .75 | ........ | 358.50 |
| Southington | 28.00 | 53.00 | 32.00 | 12.00 | 72.00 | 10.00 | ........ | 43.00 | 810.00 | 4.00 | 20.00 | 61.50 | *26.75 | 1,172.25 |
| Suffield | 15.00 | 16.00 | 18.00 | 10.00 | 15.00 | 6.00 | 2.00 | 31.00 | 242.00 | 8.00 | 9.00 | ........ | †24.00 | 396.00 |
| Tolland County, East | 18.00 | 17.00 | 3.00 | 4.75 | 55.00 | 10.25 | ........ | 26.50 | ........ | 3.75 | 2 00 | 7.25 | 154.00 | 301.50 |
| Union (Falls Village) | 7.00 | 22.00 | 4.00 | 2.00 | 46.50 | 11.00 | 8.00 | 45.00 | 675 00 | 13.00 | 3.00 | 1.00 | 14.00 | 851.50 |
| Union (Somers, etc.) | 4.00 | 7.00 | 5.00 | 1.50 | 19.75 | 13.00 | ........ | 19.00 | ........ | 3.50 | 4.00 | 1.00 | 9.60 | 85.35 |
| Union (Monroe, etc.) | 12.00 | 28.00 | ........ | 2 50 | 114.00 | 21.00 | 7.00 | 55.00 | 235.00 | 10.00 | 8.00 | 26.25 | ........ | 518.75 |
| Watertown | 21.00 | 46 00 | 10.00 | 6.00 | 115.00 | 45.00 | 5.00 | 88.00 | 1,000.00 | 34.00 | 12.00 | 131.25 | ‡32.00 | 1,548.25 |
| Westbrook | 9.00 | 16.50 | 8 00 | 11.50 | 20.00 | 7.00 | 3.00 | 18.50 | ........ | 26.50 | 7.50 | 16.25 | 5.00 | 148.75 |
| Woodbridge and Bethany | 3.00 | 8.00 | .75 | ........ | 12.00 | 4.50 | 9.00 | 41.00 | ........ | ........ | ........ | 22.50 | ........ | 100 75 |
| Woodbury | 4.20 | 9.80 | 8.10 | 3.15 | 39.20 | 24.30 | ........ | ........ | 125.00 | ........ | ........ | ........ | 12.60 | 229.35 |
| Woodstock | 15.00 | 41.00 | 28.00 | 15.00 | 65.00 | 31.50 | ........ | 82.00 | 131.00 | 18.00 | 12.00 | 75.00 | §55.00 | 568.50 |

* Trained Steers, $20.00. † Herds and strings of Cattle. ‡ Trained Steers, $18.00. § Farm and parish teams.

## ANALYSIS OF PREMIUMS AND GRATUITIES.—CONTINUED.
### FARM PRODUCTS.

| SOCIETIES. | Indian Corn. | Wheat. | Rye. | Barley. | Oats. | Beans. | Grass Seeds. | Potatoes. | Carrots. | Beets. | Parsnips. | Turnips. | Onions. | Other Products. | Total amount for Grain and Root Crops. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connecticut State | $15.50 | $3.50 | $3.50 | $3.50 | $3.50 | $6.50 | $5.50 | $11.00 | $5.00 | $8.00 | $1.00 | $2.00 | $5.00 | .... | $73.50 |
| New London County | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 33.56 |
| Fairfield County | .... | .... | .... | .... | .... | .... | 16.75 | 11.25 | 50 | 1.50 | .... | .... | 5.50 | $16.50 | 52.00 |
| Windham County | 1.50 | .... | 1.50 | .... | 1.50 | 3.00 | .... | 14.25 | 75 | 1.50 | 50 | 1 50 | 2.75 | 11.00 | 39.75 |
| Tolland County | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 16.00 |
| Chester | 2.00 | .... | 1.00 | .... | 50 | 4.20 | .... | 5.05 | 75 | 1.05 | 40 | 1.30 | 1.40 | 6.70 | 21 35 |
| Clinton | 7.10 | 30 | 50 | .... | 30 | 3.50 | 60 | 5.30 | 80 | 2.20 | 50 | 1.20 | 1.00 | .... | 23.30 |
| Danbury | 11.75 | 3.50 | 2.50 | .... | 5.50 | 1.00 | .... | 23.00 | 75 | 5.25 | 1.00 | 6.50 | 7.50 | 32.50 | 100.75 |
| Guilford | 11.50 | 2.25 | 1.25 | 50 | 1.25 | 6.00 | .... | 21.25 | 75 | 4.00 | 50 | 75 | 3.50 | 17.00 | 70.50 |
| Harwinton | 75 | 1.00 | 75 | .... | 50 | .... | .... | 75 | .... | 75 | .... | .... | 75 | 1.50 | 6.75 |
| Milford and Orange | 5.55 | 25 | 75 | .... | 75 | 75 | .... | 5.50 | .... | .... | .... | 75 | 2.25 | .... | 16.55 |
| New Milford | 2.50 | .... | .... | .... | 50 | .... | .... | 2.50 | 25 | 1.00 | .... | 75 | 75 | 2.50 | 10.00 |
| Pequabuck | 75 | 1.00 | 1.50 | .... | 50 | 1.00 | .... | 11.00 | 50 | 1.00 | .... | 1.50 | 1.00 | 5.00 | 24.75 |
| Simsbury | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 7 10 |
| Southington | 5.25 | 1.50 | 2.00 | .... | 1.50 | 3.00 | .... | 6.50 | 75 | 1.50 | 25 | 75 | 2.25 | 17.25 | 42.50 |
| Suffield | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Tolland County East | 1.75 | 50 | 1,50 | 75 | 75 | 1.50 | .... | 6.50 | .... | .... | .... | .... | 50 | 4.50 | 18 25 |
| Union (Falls Village) | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4.50 |
| Union (Somers, etc.) | 50 | 75 | 25 | .... | .... | .... | .... | 3.75 | .... | 25 | .... | .... | 75 | .... | 6 25 |
| Union (Monroe, etc.) | 7.25 | 1.00 | 3.00 | .... | 1.50 | 2.50 | .... | 22.00 | .... | 3.50 | 50 | 1.25 | 4.50 | 7.00 | 51.50 |
| Watertown | 2.75 | 1.00 | 1.75 | .... | 75 | 75 | 50 | 21.50 | 75 | 1.50 | 75 | 1.50 | 2.25 | 16.00 | 51.75 |
| Westbrook | 11.00 | 1.75 | 1.25 | .... | 50 | 4.20 | 1.25 | 8.25 | 60 | .... | .... | 3.40 | 5.35 | 5.15 | 42.70 |
| Woodbridge and Bethany | 16.00 | 2.75 | 1.25 | 75 | 1.25 | 3.25 | .... | 24.50 | 75 | 4.50 | 75 | 3.00 | 3.75 | .... | 62.50 |
| Woodbury | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| Woodstock | 9.50 | 2.50 | 1.50 | 1.00 | 1.50 | 1.75 | .... | 13.50 | 1.50 | 5.50 | .... | 3.50 | 1.50 | .... | 43.25 |

## ANALYSIS OF PREMIUMS AND GRATUITIES.—Continued.
### FARM PRODUCTS.

| SOCIETIES. | Fruits. | Flowers. | Other cult. crops. | Butter. | Cheese. | Honey and Wax. | Bread and Cake. | Sugar, Syrup, Preserved Fruit. | Total amount paid Farm Products. | Agricultural Implements. | Mechanical Inventions. | Fine Arts and Fancy Articles. | Decorated Carts & Trains of Oxen. | Medals. | Diplomas. | Miscellaneous. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Connecticut State | $140.50 | $18.50 | $38.00 | $20.00 | $8.00 | $4.00 | $21.50 | $17.00 | $341.00 | $95.00 | $15.00 | $136.00 | $20.00 | [1] 34 | 100 | .... |
| New London County | 12.25 | 9.50 | .... | 13.25 | 8.25 | 5.25 | 2.25 | .... | 84.31 | ... | 44.45 | 15.35 | 84.31 | .. | 3 | [2] $13.00 |
| Fairfield County | 77 00 | 58.00 | 7.50 | 3.00 | .... | 3.00 | 17.00 | 10.00 | 227.50 | 31.50 | 12.00 | 139.25 | 25.00 | 25 | 19 | .... |
| Windham County | 55.00 | 59.75 | .... | 14.00 | 14.00 | 2.00 | 9.00 | 9.00 | 202.50 | 15.50 | 72.25 | 65.25 | .... | .. | .. | .... |
| Tolland County | 28.50 | .... | .... | 1.50 | .... | .... | .... | .... | 46.00 | .... | 7.50 | 9.75 | .... | .. | 6 | [3] 5.00 |
| Chester | 15.20 | 50 | .... | .... | 50 | 30 | 3.50 | 9.80 | 55.10 | 1.00 | .... | 16.80 | 16.00 | .. | .. | .... |
| Clinton | 20.25 | 5.50 | 13.40 | 1.25 | .... | 1.10 | 8.70 | 5.50 | 79.00 | 3.40 | 10.00 | 24.70 | 4.50 | .. | .. | .... |
| Danbury | 182.50 | 154.00 | .... | 8.00 | .... | 1.25 | 37.25 | 42.00 | 525.75 | 36.00 | 301.00 | 409.35 | [4] 138.00 | .. | 20 | [5] 205.00 |
| Guilford | 45.00 | 4.00 | .... | 75 | .... | 1.25 | 10.75 | 3.50 | 135 75 | .... | 3.00 | 18.25 | .... | .. | .. | ... |
| Harwinton | .... | 2.50 | 2.75 | 75 | 75 | .... | 2 25 | 50 | 15.25 | .... | 2.25 | 75 | 160.00 | .. | .. | .... |
| Milford and Orange | 12.95 | 13.00 | .... | .... | ... | .... | 1.00 | 1.00 | 44.50 | .... | 25.00 | 34.21 | 20.00 | .. | .. | .... |
| New Milford | 15.25 | 8.25 | .... | .... | 1.00 | 1.50 | 3.25 | 7.00 | 57.00 | 50 | 2.50 | 56.00 | 64.00 | .. | .. | .... |
| Pequabuck | 10.50 | 1.75 | .... | 1 50 | 1.00 | .... | 4.75 | 3.00 | 22.50 | .... | 21.50 | 26.50 | ... | .. | .. | [6] 11.50 |
| Simsbury | 2.50 | 1.00 | .... | 1.25 | .... | .... | 1.25 | 1.50 | 14.60 | 4.00 | 15.25 | 19.74 | .... | .. | .. | ... |
| Southington | 24.75 | 2.50 | .... | 6.00 | .... | .... | 4.50 | .... | 80.25 | .... | .... | 26.75 | 17.00 | .. | 8 | .... |
| Suffield | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .. | .. | .... |
| Tolland County, East | 13.50 | .... | .... | 1.50 | 1.00 | 75 | 3.50 | 8.75 | 47.25 | .... | 130.75 | 4.75 | .... | .. | .. | [9] 3.00 |
| Union (Falls Village) | 7.00 | 4.50 | .... | 6.00 | 1.00 | 50 | 50 | 2.50 | 26.50 | 9.00 | 17.00 | 14.50 | .... | .. | 13 | .... |
| Union (Somers, etc.) | 3.50 | .... | 1.50 | 1.75 | 50 | .... | 3.50 | 1.00 | 18.00 | 5.00 | 1.50 | 6.50 | .... | .. | .. | [9] 20.00 |
| Union (Monroe, etc.) | 59.00 | 9.00 | .... | 6.00 | .... | 2.00 | 17.00 | 2.25 | 149.75 | .... | .... | 50.75 | .... | .. | .. | .... |
| Watertown | 18.75 | 10.25 | 9.00 | 3.00 | 3.00 | 1.50 | 2.50 | 8.50 | 108.25 | 11.50 | 31.00 | 22 00 | 5.00 | .. | 1 | .... |
| Westbrook | 19.90 | 6.30 | 16.80 | 50 | .... | 1.00 | 6.50 | 17.40 | 111.10 | 14.45 | 26.30 | 27.20 | 10.00 | .. | .. | [7] 10.00 |
| Woodbridge and Bethany | 59.75 | 10.50 | .... | 2.50 | 50 | 1.00 | 3.75 | 2.50 | 143.00 | .... | 6.25 | 23.50 | 43.00 | .. | .. | .... |
| Woodbury | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | ... | .. | .. | .... |
| Woodstock | 37.00 | 57.25 | 13.52 | 6.00 | 5.00 | 1.00 | 7.00 | 6.25 | 176.27 | 10.00 | 49.30 | 25.00 | .... | .. | .. | [8] 48.00 |

[1] 14 Gold Medals, 20 Silver. [2] Plowing at Exhibition. [3] Saddle Horses. [4] 130 Yoke of Oxen. [5] Amusements. [6] Pet Animals, $8.00; Coins, 3.50. String Teams, 7.00; Plowing, 3.00. [8] Plowing. [9] Management of Farms.

## OFFICIAL LIST OF FARMERS' CLUBS IN CONNECTICUT—1882-3.

| NAME OF CLUB. | PRESIDENT. | SECRETARY. |
|---|---|---|
| New Haven County,.... | Prof. Wm. H. Brewer, | Cullen B. Foote. |
| Bethlehem, ............ | L. F. Scott,.......... | G. F. Stone. |
| Bristol, ................ | S. R. Gridley,........ | John Winslow. |
| Cheshire, .............. | Charles S. Gillette,... | N. S. Platt. |
| Chester, ............... | A. H. Gilbert,........ | C. E. Lord. |
| Clinton, ............... | George E. Elliot,..... | Sylvester Hull. |
| Columbia, ............. | Joseph Hutchins,..... | W. H. Yeomans. |
| East Windsor,......... | John B. Noble,....... | John S. Fitts. |
| Guilford,. ............ | Sidney W. Leete,.... | R. H. Woodruff. |
| Hamden, .............. | G. W. Bradley,....... | C. P. Augur. |
| Killingworth,.......... | L. L. Nettleton,...... | Francis Turner. |
| Lebanon, ............. | O. E. Pettis,.......... | Wm. Huntington. |
| Meriden, ............. | Oliver Rice,.......... | L. E Coe. |
| Middlefield,............ | H. W. Hurlburt,..... | P. M. Augur. |
| Morris, ................. | A. C. Tracy,......... | S. W. S. Skilton. |
| Mystic................. | Josiah Hammond,.... | Silas Whipple. |
| Naugatuck, ............ | J. B. Tolles,......... | M. S. Baldwin. |
| Newington, ............ | H. A. Whittlesey,.... | J. S. Kirkham. |
| North Stonington,...... | T. W. Wheeler,...... | F. S. Peabody. |
| New Britain,........... | L. S. Wells,.......... | A. C. Blake. |
| Pomfret, .............. | C. D. Williams,...... | Martin Parker. |
| South Coventry,........ | P. H. Peterson,...... | B. S. Warner. |
| Tunxis, .............. | E. C. Ayer,.......... | A. Porter. |
| West Cornwall,........ | Dwight Rogers,...... | T. S. Gold. |
| Westport, ............. | Wm. J. Jennings,.... | S. B. Sherwood. |
| Willimantic,........... | N. P. Perkins,........ | George H. Andrews. |
| Wilton,................ | D. N. Van Hoosear,.. | D. H. Van Hoosear. |
| Wolcott,............... | Harmon Paine,........ | Edwin A. Todd. |
| Woodstock,........... | A. A. Paine,......... | Dr. G. A. Bowen. |

THE SEASON OF 1882

has had its peculiarities, and these have been so marked as to be worthy of record.

April, May, and June had a moderate temperature, with frequent light rains, and hence were very favorable for the growth of grass and winter grain. Everything that had survived the winter recovered marvelously, and yielded satisfactorily. Corn came on slowly, and rarely was so small in July as this year. Then began a drouth, pinching the pastures, and in many cases destroying all growing crops. Tobacco, corn, potatoes, turnips, and gardens were a general failure in sandy, gravelly land. The late, warm autumn, frosts being delayed till October, gave some compensation, and crops not destroyed by drouth matured well. Yet for the whole State a loss of thirty-three per cent. must be admitted from the drouth, as the crops ranged anywhere from very good to a total failure.

To sum up: April 1st, winter grain and grass in poor condition; improved rapidly; weather favorable for seeding spring and summer crops. July 1st, small hopes for corn, but same cause that ruined some fields saved others. Early potatoes good; late ones failed.

Fruit was variously affected.

Peaches were destroyed by the winter, and rarely bloomed. Plums and cherries were similarly affected in less degree. Pears bloomed sparsely, fruit scarce and indifferent.

Apples bloomed abundantly, but from drouth or other causes failed in many parts of the State. In some towns in the northwestern part of the State the crop was abundant, and of excellent quality. The same was true of portions of Windham County. Elsewhere the Autumn heat, continuing into October, caused prematurity and decay even of winter sorts. The West had no surplus and the prices have ruled high in our markets, from two to four dollars per barrel for fair fruit.

Farmer's produce has generally brought good prices. Corn, .75 to $1.00 per bushel; Oats, .55 to .65; Rye, .70 to .90; Wheat, $1.20 to $1.50; Potatoes, .60 to $1.00; Hay, $10 to $20 per ton; Milk, .02¼ to .04 per quart; Butter, .20 to .40; Cheese, .10 to .14; Beef sides, .06 to .08; Pork, .08 to .10; Eggs, .15 to .40; Poultry, dressed, .18 to .25; Wheat bran, $20 to $22 per ton; Linseed meal, new process, $28 to $30; Cotton seed meal, $26 to $30; Apples, $1.50 to

$4.00 per barrel; Wool, .30 to .45; Tobacco, .08 to .15. These prices cover the variations for good articles at different seasons of the year, but do not attempt to represent the extremes that sometimes have been attained. Creamery butter has ruled steady from .30 to .45. Working oxen, $125 to $200; Milch cows, $30 to $60; leaving out of account prices of choice Jerseys, Guernseys, Ayrshires, Swiss, and Holsteins, which are the most popular breeds at this date in the State, and largely superseding the favorite Devon and Durham, which have been the source of so much improvement in the past, the demand for milk and its products having caused increased attention to the so called milking breeds.

As a report for 1882, this brief record may prove instructive in future time.

T. S. G.

# TREASURER'S REPORT.

NATHAN HART, Treasurer, *in account with*

THE CONN STATE BOARD OF AGRICULTURE.

RECEIVED.

| | | | |
|---|---|---|---|
| Jan. 18, 1882, | Balance from report Jan. 12, 1881, - - | | $322.37 |
| 18, | " Special appropriation, - - - | | 6.50 |
| 2, 1883, | From State Treasurer, - - - - | | 2,500.00 |
| | | | $2,828.87 |

PAID.

| | | | |
|---|---|---|---|
| Feb. 17, 1882, | J. M. W. Yerrington, stenographer, - - | | $156.50 |
| Mar. 20, | P. M. Augur, pomologist, - - - | | 100.00 |
| July 14, | Brown & Gross, book and stationery, - - | | 8.65 |
| Oct. 16, | G. H. Parkinson, veterinary, - - - | | 3.00 |
| Dec. 18, | H. L. Stewart, member of Board, - - | | 31.70 |
| Jan. 4, 1883, | Albert Day, " " " - - | | 34.37 |
| 4, | J. M. Hubbard, " " " - - - | | 15.10 |
| 4, | F. E. Rice, veterinary, - - - - | | 18.00 |
| 4, | Jas. J. Webb, member of Board,- - - | | 40.30 |
| 4, | A. Warner, " " " - - - | | 38.00 |
| 4, | P. M. Augur, pomologist,- - - | | 22.95 |
| 4, | The Case, Lockwood & Brainard Co., printing, | | 230.68 |
| 10, | T. S. Gold, Secretary, salary, - - | $700.00 | |
| | Express and freight, - - | 38.64 | |
| | Telegrams, - - - | 3.58 | |
| | Traveling expenses, - - | 219.50 | |
| | Postage, - - - | 69.56 | |
| | Stationery, - - | 6.80 | |
| | Printing (Bridgeport Standard), - - - | 4.50 | |
| | H. C. Harvey, - - | 110.50 | |
| | Sundry expenses at Rockville, - - - | 4.13 | |
| | Miss Mary H. Reed, - - | 28.63 | |
| | W. A. Stearns, - - | 44.35 | |
| | L. Hodges, - - - | 26.85 | |
| | A. Bradley, - - - | 28.45 | |
| | J. B. Olcott, - - - | 25.00 | |
| | Dr. G. A. Bowen, - - | 26.45 | |
| | Prof. W. H. Brewer, - | 26.50 | |
| | H. E. Alvord, - - | 30.00 | |
| | | | $1,393.44 |

| | | | |
|---|---|---|---|
| Jan. | 4, 1883, | S. B. West, member of Board, - - - | 10.50 |
| | 10, | Nathan Hart, expenses as Treasurer, - - | 36.35 |
| | | J. W. Reuwet, killing horse, - - - | 5.00 |
| | | Philip Bacon, " " - - - | 5.00 |
| | | Brown & Gross, stationery, - - - | 3.05 |
| | | J. P. Barstow, member of Board, - - | 39.00 |
| | | A. R. Goodrich, " " " - - - | 21.50 |
| | | S. R. Gridley, use of team, - - - | 2.00 |
| | | Jas. A. Bill, member of Board, - - - | 36.00 |
| | | E. H. Hyde, Commissioner, - - - | 153.84 |
| | | Balance in Treasury, - - - - | 423.94 |
| | | | $2,828.87 |

WEST CORNWALL, CONN., Jan. 10, 1883.

Audited and approved.

J. M. HUBBARD, } *Auditors.*
JAS. A. BILL, }

STATE OF CONNECTICUT.

# ANNUAL REPORT

OF

# The Connecticut Agricultural

# EXPERIMENT STATION

For 1882.

PRINTED BY ORDER OF THE LEGISLATURE.

NEW HAVEN:
TUTTLE, MOREHOUSE & TAYLOR, PRINTERS.
1883.

# OFFICERS

OF

# The Connecticut Agricultural Experiment Station,

## 1882.

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## STATE BOARD OF CONTROL.

*Ex-officio.*
HIS EXC. HOBART B. BIGELOW, *President.*

| | Term expires |
|---|---|
| *Appointed by Connecticut State Agricultural Society:* | |
| HON. E. H. HYDE, Stafford, *Vice-President.* | 1885. |
| *Appointed by Board of Trustees of Wesleyan University:* | |
| PROF. W. O. ATWATER, Middletown. | 1882. |
| *Appointed by Board of Agriculture:* | |
| T. S. GOLD, West Cornwall. | 1883. |
| *Appointed by Governor and Senate:* | |
| EDWIN HOYT, New Canaan. | 1883. |
| JAMES J. WEBB, Hamden. | 1884. |
| *Appointed by Governing Board of Sheffield Scientific School:* | |
| W. H. BREWER, New Haven, *Secretary and Treasurer.* | 1884. |
| *Ex-officio.* | |
| S. W. JOHNSON, New Haven, *Director.* | |

*Executive Committee* (James J. Webb, W. H. Brewer, S. W. Johnson)

---

*Chemists.*

E. H. JENKINS, PH.D.
C. A. HUTCHINSON, B.S.
GEO. ARCHER, from April to September

*In charge of Buildings and Grounds.*
CHARLES J. RICE.

# ANNOUNCEMENT.

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION was established in accordance with an Act of the General Assembly, approved March 21, 1877, "for the purpose of promoting Agriculture by scientific investigation and experiment."

The Station is prepared to analyze and test fertilizers, cattle-food, seeds, soils, waters, milks, and other agricultural materials and products, to identify grasses, weeds, and useful or injurious insects, and to give information on the various subjects of Agricultural Science, for the use and advantage of the Citizens of Connecticut.

The Station makes analyses of Fertilizers, Seed-Tests, &c., &c. for the Citizens of Connecticut *without charge*, provided—

1. That the results are of use to the public and are free to publish.
2. That the samples are taken by *consumers* from stock now in the market, and in accordance with the Station instructions for sampling.
3. That the samples are fully described on the Station "Forms for Description."

All other work proper to the Experiment Station that can be used for the public benefit will be made without charge. Work done for the use of individuals will be charged for at moderate rates. The Station will undertake no work, the results of which are not at its disposal to use or publish, if deemed advisable for the public good. See p. 15.

Results of analysis or investigation that are of general interest will be published in Bulletins, of which copies are sent to each Post Office in this State, and will be summed up in the Annual Reports made to the Legislature.

The officers of the Station will take pains to obtain for analysis samples of all the commercial fertilizers sold in Connecticut; but the organized coöperation of the farmers is essential for the full and timely protection of their interests. Farmers' Clubs and like Associations can efficiently work with the Station for this purpose, by sending in samples early during each season of trade.

It is the wish of the Board of Control to make the Station as widely useful as its resources will admit. Every Connecticut citizen who is concerned in agriculture, whether farmer, manufacturer, or dealer, has the right to apply to the Station for any assistance that comes within its province to render, and the Station will respond to all applications as far as lies in its power.

☞ Instructions and Forms for taking samples, and Terms for testing Fertilizers, Seeds, etc., for private parties, sent on application.

☞ Parcels by Express, to receive attention, should be prepaid, and all communications should be directed, not to individual officers, but simply to the

AGRICULTURAL EXPERIMENT STATION,
NEW HAVEN, CONN.

☞ Station Grounds, Laboratory and Office are on Suburban St., between Whitney Avenue and Prospect St., $1\frac{5}{8}$ miles North of City Hall. Suburban St. may be reached by Whitney Lake Horse Cars, which leave corner of Chapel and Church Sts. each hour and half hour.

☞ The Station has Telephone connection and may be spoken from the Central Telephone Office, 346 State St., or from Peck and Bishop's Office in Union R. R. Depot.

# CONTENTS.

## ERRATA.

Page 14, 3d line from top, read *ingredients* instead of *ingredient.*
Page 16, 10th line from top, read *nor* instead of *or.*
Page 17, 14th line from top, read *samples* instead of *same.*
Page 32, 1st line from top, read *phates*, 8, *superphosphates.*
Page 65, 5th line from bottom, read *Our* instead of *One.*
Page 88, 17th line from top, read *the specific gravity* instead of *it.*

# REPORT OF THE BOARD OF CONTROL.

*To the General Assembly of the State of Connecticut:*

GENTLEMEN:—The Board of Control of THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION herewith submits to your Honorable Body the Annual Reports of the Director and Treasurer made to this Board at its Annual Meeting held at the State House in Hartford, January 16th, 1883.

We beg leave to say that at a special meeting of this Board held May 9th, various parcels of ground were visited and one chosen for purchase for the use of the Station, and a special committee was appointed to carry out the objects of the act passed by the Legislature at its last session, appropriating twenty-five thousand dollars "for the purpose of buying a suitable lot and erecting thereon buildings and equipping the same for the permanent use of said Station." (See p. 108.)

The special committee was made up of His Excellency Hobart B. Bigelow, chairman, J. J. Webb, vice-chairman, William H. Brewer, secretary, S. W. Johnson and T. S. Gold. This committee reports that the property recommended by the Board of Control for purchase was bought May 9th, 1882; it consists of about five acres of land situated on Suburban St., nearly one mile and five-eighths in air line from the City Hall of New Haven, having on it a commodious dwelling house, a barn and well. A substantial brick building has been erected for a chemical laboratory. Water and gas have been laid on. The fixtures of the laboratory are nearly complete. Most of the needed repairs on the house and barn have been made, and the further equipment is in progress and well advanced. The original property cost $12,000.00, and $8,809.04 have thus far been paid out on the new building and for repairs and equipment.

The usual work of the Station went on in the rooms of the Sheffield Scientific School until September 1st, when the Station office was opened at its new and permanent quarters.

The last Annual Report was bound and distributed as heretofore with the Report of the Board of Agriculture. By Special Resolution the Legislature ordered the printing of 2000 extra copies, a large share of which were distributed in advance of the regular edition. These extra copies cost less than 10 cents each, and the demand for them makes similar action desirable this year.

THOMAS M. WALLER,
*President.*

WM. H. BREWER,
*Secretary.*

# REPORT OF THE TREASURER.

Wm. H. Brewer, *in account with The Connecticut Agricultural Experiment Station.*

### Receipts.

| | | |
|---|---|---|
| Balance from account of 1881, | $611.09 | |
| Licenses for sale of Fertilizers, | 315.00 | |
| Miscellaneous Receipts, | 705.67 | |
| State Treasurer—Annual Appropriation, | 7,000.00 | |
| | | $8,631.76 |

### Payments.

| | | |
|---|---|---|
| Salaries, | $4,411.67 | |
| Laboratory Expenses, | 763.87 | |
| Printing, Postage and Stationery, | 369.79 | |
| Traveling Expenses of the Board, | 63.33 | |
| Gas and Fuel, | 235.50 | |
| General Expenses, | 1,113.92 | |
| Cash Balance on hand, | 1,673.68 | |
| | | $8,631.76 |

WM. H. BREWER,
*Treasurer.*

### Memorandum.

There is due the Experiment Station one hundred ten $\frac{30}{100}$ dollars for laboratory work and the outstanding bills and liabilities (mostly for apparatus and material) are estimated to amount to seventeen hundred (1700) dollars.

Of the special appropriation "for the purpose of buying a suitable lot and erecting thereon buildings and equipping the same for the permanent use of the Station," twenty thousand eight hundred nine dollars and four cents ($20,809.04) have been paid out for property purchased and for work already done and accepted.

WM. H. BREWER,
*Treasurer.*

# REPORT OF THE DIRECTOR.

The chemical work done at the Station during the year 1882 was necessarily completed for the most part previous to Sept. 1, as on that day the rooms in Sheffield Hall which had been occupied for five years and two months as laboratory and office were vacated, the Station property having been packed up and stored, to await the completion of its new laboratory. Notwithstanding this short period of work nearly the usual number of ferti izer analyses were made, viz: 151, and of these a large proportion were on samples of complex composition.

Two samples of soil and three of swamp muck have been examined. The results are set forth on subsequent pages, with such comments as seem appropriate.

In response to an application from the Wilton Farmer's Club, through the secretary, D. H. Van Hoosear, Esq., five samples of fine salt and one of saltpeter have been submitted to analysis, and their use as antiseptic or preservative material discussed in answering several questions proposed by the Club.

The testing of milk has assumed much prominence, 216 analyses, partial or complete, having been executed. Dr. Jenkins has ably discussed the results of these and of the 56 samples analyzed last year, so far as they have importance for the public, in a paper which follows.

Of fodders six complete analyses and fourteen partial analyses have been undertaken. The results on ensilage will be read with special interest.

Two toxical examinations were made with negative or undecisive results.

Twenty-four seed-tests are reported, made mostly on sweet-corn and onion seed.

The Bulletins of the Station have been only five in number, but they have aggregated 34 carefully printed pages of the style of this Report, and were stitched for convenience of preservation. These have been sent as usual to all of the Agricultural Societies and Farmers' Clubs and to all the newspapers in the State. They have been reprinted in the *Connecticut Farmer* and in agricultural papers in other States. In anticipation of the act requiring the Station after Sept. 1, 1882, to "mail or cause to be mailed two copies, at least," of its bulletins, to each post-office in the State, 6,000 copies of Bulletins 71 and 72 were distributed by post in special envelopes addressed to the postmasters, on which was printed the following:

"The Director of the Connecticut Agricultural Station shall, from time to time, as bulletins of said Station may be issued, mail or cause to be mailed two copies, at least, of such bulletins to each post-office in the State."

*Section* 10 *of "An Act concerning Commercial Fertilizers," passed by the General Assembly, to take effect Sept.* 1, 1882.

☞ The postmaster will greatly serve the public by distributing the enclosed bulletins to farmers. ☜

Hereafter the Station will dispatch to every Connecticut post-office a package of each of its bulletins, so that they may be universally accessible to the farmers of Connecticut.

## Fertilizer Law.

The General Assembly at its last session passed a new Fertilizer Law, which went into effect Sept. 1, and which repeals and takes the place of all previous legislation on this subject in this State.

Since a full understanding of the provisions and penalties of this law is important to all parties who buy or sell commercial fertilizers, attention is specially directed to the following points:

1. In case of fertilizers that retail at ten dollars or more per ton, the law of 1882 holds the *seller* responsible for affixing a correct label or statement to every package or lot sold or offered, as well as for the payment of an analysis fee of ten dollars for each fertilizing ingredient which the fertilizer contains or is claimed to con-

tain, unless the manufacturer or importer shall have provided labels or statements and shall have paid the fee. Sections 1 and 3.

2. The law also requires, in case of any fertilizer selling at ten dollars or more per ton, that a certified statement of composition, net weight in package, etc., shall be filed with the Director of the Experiment Station, and that a sealed sample shall be deposited with him. Section 2.

3. It is also provided that every person in the State who sells *any commercial fertilizer of whatever kind or price* shall annually report certain facts to the Director of the Experiment Station, and on demand of the latter shall deliver a sample for analysis. Section 4.

Here follows the full text of the law:

## AN ACT CONCERNING COMMERCIAL FERTILIZERS.

General Assembly,
*January Session, A. D.* 1882.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

Section 1. Every person or company who shall sell, offer, or expose for sale, in this State, any commercial fertilizer or manure, the retail price of which is ten dollars, or more than ten dollars per ton, shall affix conspicuously to every package thereof a plainly printed statement clearly and truly certifying the number of net pounds of fertilizer in the package, the name, brand, or trade-mark under which the fertilizer is sold, the name and address of the manufacturer, the place of manufacture, and the chemical composition of the fertilizer, expressed in the terms and manner approved and currently employed by the Connecticut Agricultural Experiment Station.

If any such fertilizer be sold in bulk, such printed statement shall accompany and go with every lot and parcel sold, offered, or exposed for sale.

Sec. 2. Before any commercial fertilizer, the retail price of which is ten dollars, or more than ten dollars per ton, is sold, offered, or exposed for sale, the manufacturer, importer, or party who causes it to be sold, or offered for sale, within the State of Connecticut, shall file with the Director of the Connecticut Agricultural Experiment Station two certified copies of the statement

named in section one of this act, and shall deposit with said Director a sealed glass jar or bottle containing not less than one pound of the fertilizer, accompanied by an affidavit that it is a fair average sample thereof.

SEC. 3. The manufacturer, importer, agent, or seller of any commercial fertilizer, the retail price of which is ten dollars, or more than ten dollars per ton, shall pay, on or before the first of May, annually, to the Director of the Connecticut Agricultural Experiment Station, an analysis fee of ten dollars for each of the fertilizing ingredients contained or claimed to exist in said fertilizer: *provided*, that whenever the manufacturer or importer shall have paid the fee herein required for any persons acting as agents or sellers for such manufacturer or importer, such agents or sellers shall not be required to pay the fee named in this section.

SEC. 4. Every person in this State who sells, or acts as local agent for the sale of any commercial fertilizer of whatever kind or price, shall annually, or at the time of becoming such seller or agent, report to the director of the Connecticut Agricultural Experiment Station his name, residence, and post-office address, and the name and brand of said fertilizer, with the name and the address of manufacturer, importer, or party from whom such fertilizer was obtained, and shall, on demand of the director of the Connecticut Agricultural Experiment Station, deliver to said director a sample suitable for analysis of any such fertilizer or manure then and there sold or offered for sale by said seller or agent.

SEC. 5. No person or party shall sell, offer, or expose for sale, in the State of Connecticut, any pulverized leather, raw, steamed, roasted, or in any form, as a fertilizer or as an ingredient of any fertilizer or manure, without explicit printed certificate of the fact, such certificate to be conspicuously affixed to every package of such fertilizer or manure, and to accompany and go with every parcel or lot of the same.

SEC. 6. Every manufacturer of fish guano, or fertilizers of which the principal ingredient is fish or fish-mass from which the oil has been extracted, shall, before manufacturing or heating the same, and within thirty-six hours from the time such fish or mass has been delivered to him, treat the same with sulphuric acid or other chemical, approved by the director of said Experiment Station, in such quantity as to arrest decomposition: *provided, however*, that in lieu of such treatment such manufacturers may

provide a means for consuming all smoke and vapors arising from such fertilizers during the process of manufacture.

SEC. 7. Any person violating any provision of the foregoing sections of this act shall be fined one hundred dollars for the first offense, and two hundred dollars for each subsequent violation.

SEC. 8. This act shall not affect parties manufacturing, importing, or purchasing fertilizers for their own private use, and not to sell in this State.

SEC. 9. The director of the Connecticut Agricultural Experiment Station shall pay the analysis-fees received by him into the treasury of the Station, and shall cause one or more analyses of each fertilizer to be made and published annually. Said director is hereby authorized, in person or by deputy, to take samples for analysis from any lot or package of manure or fertilizer which may be in the possession of any dealer.

SEC. 10. The director of the Connecticut Agricultural Station shall, from time to time, as bulletins of said Station may be issued, mail or cause to be mailed two copies, at least, of such bulletins to each post-office in the State.

SEC. 11. Title sixteen, chapter fifteen, sections fifteen and sixteen, and title twenty, chapter twelve, section five of the general statutes, and chapter one hundred and twenty of the public acts of 1881, being an act concerning commercial fertilizers, are hereby repealed.

SEC. 12. This act shall take effect on the first day of September, 1882.

## FORM OF MANUFACTURER'S STATEMENT TO AFFIX TO PACKAGES.

At the request of several manufacturers, the following examples of statement are given for use in complying with Section 1 of the Act.

### JOHN DOE'S SUPERPHOSPHATE.

This lot or package (bag or barrel) contains (or is guaranteed to contain) 250 net pounds of JOHN DOE'S SUPERPHOSPHATE, manufactured at New Haven, Ct., and having the following chemical composition, per cent., viz:

| | |
|---|---|
| Nitrogen in nitrates, | 2.1 |
| " ammonia-salts, | 1.5 |
| " organic-matter, | 1.5 |
| Soluble phosphoric acid, | 8.0 |
| Reverted " " | 1.5 |
| Insoluble " " | 1.0 |
| Potash, as sulphate (or muriate), | 4.3 |

John Doe, Manufacturer, New Haven, Ct.

The above statement of chemical composition will cover SUPERPHOSPHATES and SPECIAL MANURES when it is desired to specify minutely the state of the ingredient. Ingredients that are not present may of course be omitted in the statement, and others may be named if it is desired.

In most cases manufacturers necessarily avail themselves of the cheapest sources of nitrogen, and substitute nitrates for ammonia salts or the reverse according to the state of the market. It is therefore not easy to maintain any exact distinction as to nitrates, ammonia salts and organic nitrogen. Some prefer also to group together soluble and reverted phosphoric acid, and to use low-grade potash-salts which contain both sulphates and muriates.

In such cases the statement of composition may be confined to Nitrogen, Soluble and Reverted Phosphoric acid, Insoluble Phosphoric acid, Potash.

In case of BONE, FISH, TANKAGE, DRIED MEAT, DRIED BLOOD, etc., the chemical composition may take account of the two ingredients: Nitrogen, Phosphoric acid.

For POTASH SALTS give the per cent. of Potash (potassium oxide), and of Sulphate of potash or Muriate of potash.

The chemical composition of other fertilizers may be given as found in the Station Reports.

The common use of the word "ammonia" in place of nitrogen, as applied to articles really containing no ammonia or ammonia-salts, is not "approved" as it is not "currently employed by the Connecticut Agricultural Experiment Station." The same is true of the use of the terms "available" and "assimilable" as covering soluble and reduced phosphoric acid.

The Station in analyzing the fertilizers sold under this law, as a rule, can take account of those ingredients only which are specified in the Statement that accompanies each package sold.

## FORM OF DEALER'S REPORT TO THE STATION.

Section 4 of the Act requires that every person in this State who sells or acts as local agent for the sale of any Commercial Fertilizer of whatever kind or price, shall, *annually* or *at the time of becoming* such agent or seller, make a report to the Director of the Experiment Station. The subjoined form may be used for such reports.

I (we), the undersigned, hereby report to the Director of the Connecticut Agricultural Experiment Station, as required by law, that I am agent (we are agents) for the sale of (here give correct full name and brand of fertilizer) manufactured (imported, furnished) by (here give name and address of manufacturer, importer or party from whom the fertilizer was obtained) and hold myself (ourselves) prepared to deliver to said Director a sample of the same on his demand.

Sign with name,
Residence,
Post Office Address,
And Date.

Blanks for making out these Reports will be supplied on application to the Experiment Station.

On receiving Statements and analysis-fees from manufacturers and Reports from dealers, the Station will issue receipts for the same.

## FERTILIZERS.*

In respect to its terms, the Station makes *two classes* of analyses of fertilizers and fertilizing materials: the first for the benefit of farmers, gardeners, and the public generally; the second for the private use of manufacturers and dealers. Analyses of the *first class* are made gratuitously, and the results are published as speedily and widely as possible for the guidance of purchasers and consumers. Those of the *second class* are charged for at moderate rates, and their results are not published in a way to interfere with their legitimate private use. The Station, however, distinctly reserves the liberty to use at discretion, for the public benefit, all results obtained in its laboratory, and in no case will enter into any privacy that can work against the public good.

During 1882, one hundred and fifty-one (151) samples of fertilizers have been analyzed. Of these, 34 were examined for private parties, and the remainder, 117, for the general use of the citizens of the State.

The samples analyzed for the public benefit have been sent in from various quarters of the State, in most instances by actual purchasers and consumers, in a few cases by dealers, while the Station itself, through authorized agents, has drawn a considerable number of samples from the stock of dealers and agents.

All the analyses of the first class are made on samples understood to have been taken in accordance with the printed instructions which the Station supplies to all applicants. Here follows a copy of these instructions.

* The matter of this and of several subsequent pages, explanatory of the sampling and valuation of fertilizers, is copied with a few appropriate alterations from the Report for 1881. This repetition appears to be necessary for the use of readers who have not seen former Reports.

## THE CONNECTICUT

# AGRICULTURAL EXPERIMENT STATION.

### INSTRUCTIONS FOR SAMPLING COMMERCIAL FERTILIZERS.

The *Commercial Value* of a high-priced Fertilizer can be estimated, if the amounts *per cent.* of its principal fertilizing elements are known. Chemical analysis of a small sample, so taken as to fairly represent a large lot, will show the composition of the lot. The subjoined instructions, if faithfully followed, will insure a fair sample. Especial care should be observed that the sample neither gains or loses *moisture* during the sampling or sending, as may easily happen in extremes of weather, or from even a short exposure to sun and wind, or from keeping in a poorly closed vessel.

1. Provide a tea cup, some large papers, and for each sample a glass fruit-can or tin box, holding about one quart, that can be tightly closed—all to be clean and dry.

2. Weigh separately at least three (3) average packages (barrels or bags) of the fertilizer, and enter these *actual weights* in the "Form for description of Sample."

3. Open the packages that have been weighed, and mix well together the contents of each, down to one-half its depth, emptying out upon a clean floor if needful, and crushing any soft, moist lumps in order to facilitate mixture, but leaving hard, dry lumps unbroken, so that the sample shall exhibit the texture and mechanical condition of the fertilizer.

4. Take out five (5) equal cupfulls from different parts of the mixed portions of each package. Pour them (15 in all) one over another upon a paper, intermix again thoroughly but quickly to avoid loss or gain of moisture, fill a can or box from this mixture, close tightly, *label plainly*, and send, charges prepaid, to

THE CONN. AGRICULTURAL EXPERIMENT STATION,
*New Haven, Conn.*

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The foregoing instructions may be over-nice in some cases, but they are not intended to take the place of good sense on the part of those who are interested in learning the true composition of a fertilizer. Any method of operating that will yield a *fair sample* is good enough.

In case of a fine, uniform and moist or coherent article, a butter-tryer or a tin tube, like a dipper handle, put well down into the packages, in a good number of places will give a fair sample with great ease. With dry, coarse articles, such as ground bone, there is likely to be a separation of coarse and fine parts on handling. Moist articles put up in bags or common barrels may become dry on the outside. It is in these cases absolutely necessary to mix thoroughly the coarse and fine, the dry and the moist portions before sampling. Otherwise the analysis will certainly misrepresent the article whose value it is intended to fix.

The quantity sent should not be too small. When the material is fine and uniform, and has been carefully sampled, a pint may be enough, but otherwise and especially in the case of ground bone, which must be mechanically analyzed, the same should not be *less than one quart.*

It is also important that samples for analysis should be taken at the time when the fertilizer is purchased, and immediately dispatched to the Station. Moist fish, blood or cotton seed will soon decompose and lose ammonia, if bottled and kept in a warm place. Superphosphates containing much nitrogen will suffer reversion of their soluble phosphoric acid under similar circumstances. Most of the moist fertilizers will lose water unless tightly bottled, but some of the grades of potash salts will gather moisture from the air and become a slumpy mass if not thoroughly protected.

These changes in the composition of a sample not suitably preserved must invalidate any conclusions from its analysis, and work serious injustice either to the manufacturer or to the consumer.

It doubtless often happens that a purchaser on laying in a stock of fertilizers decides that he will not then trouble the Station to analyze the goods he has obtained, but will set aside samples which he can send for examination in case the crops report adversely as to their quality. It is always better to send all samples at once to the Station where they can be directly analyzed or so prepared that they will keep without chemical change.

With the Instructions for Sampling, the Station furnishes a blank Form for Description of Samples, a copy of which is here given.

THE CONNECTICUT

# AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

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## FORM FOR DESCRIPTION OF SAMPLE.

Station No............ Rec'd at Station,..................18

Each sample of Fertilizers sent for gratuitous analysis must be accompanied by one of these Forms, with the blanks *below* filled out fully and legibly.

The filled out Form, if wrapped up with the sample, will serve as a label.

Send with each sample a specimen of any printed circular, pamphlet, analysis or statement that accompanies the fertilizer or is used in its sale.

Brand of Fertilizer,........................................

Name and address of Manufacturer,..........................

..............................................................

Name and address of Dealer from whose stock this sample is taken, ..................................................

Date of taking this sample,..................................

Selling price per ton or hundred, bag or barrel, ..............

Selling weight claimed for each package weighed,............

Actual weight of packages opened,...........................

Here write a copy of any analysis or guaranteed composition that is fixed to the packages.

..............................................................

Signature and P. O. address of person taking and sending the sample.

..............................................................

On receipt of any sample of fertilizer from the open market, the filled out "Form for Description," which accompanies it is filed in the Station's Record of Analyses and remains there as a voucher for the authenticity of the sample and for the fact that it has been taken fairly, or, at least under suitable instructions. It is thus sought to insure that manufacturers and dealers shall not suffer from the publication of analyses made on material that does not correctly represent what they have put upon the market.

The "Form for Description" when properly filled out, also contains all the data of cost, weight, etc., of a fertilizer which are necessary for estimating, with help of the analysis, the commercial value of its fertilizing elements, and the fairness of its selling price. Neglect to give full particulars occasions the Station much trouble, and it is evident that want of accuracy in writing up the Description may work injustice to the manufacturers or dealers as well as mislead consumers. It is especially important that the *Brand* of a fertilizer and its *Selling price* should be correctly given. The price should be that actually charged by the dealer of whom it is bought, and if the article be purchased in New York or other distant market, that fact should be stated and the cost at the nearest point to the consumer, on rail or boat, should be reported also.

In all cases, when possible, *ton-prices* should be given, and if the sale of an article is only by smaller quantities, that fact should be distinctly mentioned.

When a sample of fertilizer has been analyzed, the results are entered on a printed form, which is filed in the Station Record of Analyses, facing the "Description of Sample" that was received with the fertilizer to which it pertains, and there remains for future reference.

A copy of the analysis is also immediately reported to the party that furnished the sample, the report being entered on one page of another printed form and facing a second printed page of "Explanations" intended to embody the principles and data upon which the valuation of fertilizers is based.

These Explanations are essential to a correct understanding of the analyses that are given on subsequent pages and are therefore reproduced here, as follows:

EXPLANATIONS OF FERTILIZER-ANALYSIS AND VALUATION.

*Nitrogen* is commercially the most valuable fertilizing element. It occurs in various forms or states. *Organic nitrogen* is the nitrogen of animal and vegetable matters generally, existing in the albumen and fibrin of meat and blood, in the uric acid of bird dung, in the urea and hippuric acid of urine, and in a number of other substances. Some forms of organic nitrogen, as that of blood and meat, are highly active as fertilizers; others, as that of hair and leather, are comparatively slow in their effect on vegetation unless these matters are reduced to a fine powder or chemically disintegrated. *Ammonia* and *nitric acid* are results of the alteration of *organic nitrogen* in the soil and manure heap, and are the most active forms of Nitrogen. They occur in commerce—the former in sulphate of ammonia, the latter in nitrate of soda.

17 parts of ammonia, or 66 parts of pure sulphate of ammonia contain 14 parts of nitrogen.

85 parts of pure nitrate of soda also contain 14 parts of nitrogen.

*Soluble Phosphoric acid* implies phosphoric acid or phosphates that are freely soluble in water. It is the characteristic ingredient of Superphosphates, in which it is produced by acting on "insoluble" or "reverted" phosphates with oil of vitriol. It is not only readily taken up by plants, but is distributed through the soil by rains. Once well incorporated with soil it shortly becomes reverted phosphoric acid.

*Reverted* (*reduced or precipitated*) *Phosphoric acid* strictly means phosphoric acid that was once freely soluble in water, but from chemical change has become insoluble in that liquid. It is freely taken up by a strong solution of ammonium citrate, which is therefore used in analysis to determine its quantity. "Reverted phosphoric acid" implies phosphates that are readily assimilated by crops, but generally have less value than soluble phosphoric acid, because they do not distribute freely by rain.

*Insoluble Phosphoric acid* implies various phosphates not freely soluble in water or ammonium citrate. In some cases the phosphoric acid is too insoluble to be rapidly available as plant food. This is true of South Carolina rock phosphate, of Navassa phosphate, and especially of Canada apatite. The phosphate of coarse raw bones is at first nearly insoluble in this sense, because of the animal matter of the bone which envelopes it, but when the latter decays in the soil, the phosphate remains in essentially the "reverted" form.

*Potash* signifies the substance known in chemistry as potassium oxide, which is the valuable fertilizing ingredient of "potashes" and "potash salts." It is most costly in the form of sulphate, and cheapest in the shape of muriate or chloride.

*The Valuation of a Fertilizer* signifies estimating its worth in money, or its trade-value; a value which, it should be remembered, is not *necessarily* proportional to its fertilizing effects in any special case.

Plaster, lime, stable manure and nearly all the less expensive fertilizers have variable prices, which bear no close relation to their chemical composition, but guanos, superphosphates and other fertilizers, for which $30 to $80 per ton are paid, depend chiefly for their trade-value on the three substances, *nitrogen*, *phosphoric acid* and *potash*, which are comparatively costly and steady in price. The money-value per pound of these ingredients is easily estimated from the market prices of the standard articles which furnish them to commerce.

*The average Trade-values*, or cost in market per pound, of the ordinarily occurring forms of nitrogen, phosphoric acid and potash, as found in the Connecticut and New York markets, and employed by the Station during the last two years, have been as follows:

| TRADE-VALUES FOR 1881 AND 1882. | 1881. Cents per lb. | 1882. Cents per lb. |
|---|---|---|
| Nitrogen in nitrates, | 26 | 26 |
| " in ammonia salts, | 22½ | 29 |
| " in Peruvian Guano, fine steamed bone, dried and fine ground blood, meat and fish, superphosphates and special manures. | 20 | 24 |
| " in coarse or moist blood, meat or tankage, in cotton seed, linseed and Castor Pomace, | 16 | 18 |
| " in fine ground bone, horn and wool dust, | 15 | 17 |
| " in fine medium bone, | 14 | 15 |
| " in medium bone, | 13 | 14 |
| " in coarse medium bone, | 12 | 13 |
| " in coarse bone, horn shavings, hair and fish scrap, | 11 | 11 |
| Phosphoric acid soluble in water, | 12½ | 12½ |
| " " "reverted" and in Peruvian Guano, | 9 | 9 |
| " " insoluble, in fine bone. fish guano and superphosphates, | 6 | 6 |
| " " " in fine medium bone, | 5½ | 5½ |
| " " " in medium bone, | 5 | 5 |
| " " " in coarse medium bone, | 4½ | 4½ |
| " " " in coarse bone, bone ash and bone black, | 4 | 4 |
| " " " in fine ground rock phosphate, | 3½ | 3 |
| Potash in high grade sulphate, | 7½ | 7 |
| " in low grade sulphate and kainite, | 5½ | 5 |
| " in muriate or potassium chloride, | 4½ | 5 |

*These "trade-values" of the elements of fertilizers* are not fixed, but vary with the state of the market, and are from time to time subject to revision. They are not exact to the cent or its fraction, because the same article sells cheaper at commercial or manufacturing centers than in country towns, cheaper in large lots than in small, cheaper for cash than on time. These values are high enough to do no injustice to the dealer, and properly interpreted, are accurate enough to serve the object of the consumer.

*To Estimate the Value of a Fertilizer* we multiply the per cent. of nitrogen, etc., by the trade-value per pound, and that product by 20; we thus get the values per ton of the several ingredients, and adding them together we obtain the total estimated value per ton.

In case of *Ground bone*, the fineness of the sample is graded by sifting, and we separately compute the nitrogen value of each grade of bone which the sample contains, by multiplying the pounds of nitrogen per ton in the sample, by the per cent. of each grade, taking one one-hundredth of that product, multiplying it by the estimated value per pound of nitrogen in that grade, and taking this final product as the result in cents. Summing up the separate values of each grade, thus obtained, together with the values of each grade for phosphoric acid, similarly computed, the total is the estimated value of the sample of bone. For further particulars, see page 38.

*The uses of the "Valuation"* are, 1st, to show whether a given lot or brand of fertilizer is worth as a commodity of trade what it costs. If the selling price is no higher than the estimated value, the purchaser may be quite sure that the price is reasonable. If the selling price is but \$2 to \$3 per ton more than the estimated value, it may still be a fair price; but if the cost per ton is \$5 or more over the estimated value, it would be well to look further. 2d, Comparisons of the estimated values and selling prices of a number of fertilizers will generally indicate fairly which is the best for the money. But the "estimated value" is not to be too literally construed, for analysis cannot always decide accurately what is the *form* of nitrogen, etc., while the mechanical condition of a fertilizer is an item whose influence cannot always be rightly expressed or appreciated.

*The Agricultural value* of a fertilizer is measured by the benefit received from its use, and depends upon its fertilizing effect, or crop-producing power. As a broad, general rule, it is true that

Peruvian guano, superphosphates, fish-scraps, dried blood, potash salts, plaster, etc., have a high agricultural value which is related to their trade-value, and to a degree determines the latter value. But the rule has many exceptions, and in particular instances the trade-value cannot always be expected to fix or even to indicate the agricultural value. Fertilizing effect depends largely upon soil, crop and weather, and as these vary from place to place and from year to year, it cannot be foretold or estimated except by the results of past experience, and then only in a general and probable manner.

For the above first-named purpose of valuation, the trade-values of the fertilizing elements which are employed in the computations should be as exact as possible, and should be frequently corrected to follow the changes of the market.

For the second-named use of valuation, frequent changes of the trade-values are disadvantageous, because two fertilizers cannot be compared as to their relative money-worth, when their valuations are estimated from different data.

Experience leads to the conclusion that the trade-values adopted at the beginning of a year should be adhered to as nearly as possible throughout the year, notice being taken of considerable changes in the market, in order that due allowance may be made therefor. It should be remembered that, in an Annual Report, the fluctuations in trade-value that may occur within the year cannot be accurately followed, and the comparisons of estimated values are mostly in retrospect.

The valuations for 1882 were adopted in consultation with Dr. Goessmann, Inspector of Fertilizers for Massachusetts, and Prof. Cook, Director of, and Dr. Neale, Chemist to, the New Jersey Agricultural Experiment Station, and have been employed by these gentlemen in their official Reports for 1882.

## ANALYSES AND VALUATIONS OF FERTILIZERS.

The classification of the Fertilizers analyzed in the Station Laboratory from Nov. 1st, 1881, to Sept. 1st, 1882, is as follows:

13 phosphate rocks and phosphatic (non-nitrogenous) guanos.
4 plain (non-nitrogenous) superphosphates.
49 nitrogenous (ammoniated) superphosphates and guanos.
23 special fertilizers or "formulas."
18 bone manures.
2 fish manures.
6 nitrates.
1 sulphate of ammonia.
6 dried blood and tankage.
1 dried meat.
4 castor pomace and cotton seed meal.
1 fowl manure.
1 compost of tripe refuse.
1 damaged tea.
9 potash salts.
1 plaster.
2 slaked lime.
2 limestones.
2 marls.
1 "Norfolk Fertilizer."
1 marine mud.
3 mucks.

151

Of this number 34 were analyzed for private parties, and are only noticed in the following pages when the results are of general interest and value.

### Native Phosphates.

Phosphate Rock, **708.** This sample, sent by H. H. Austin, Suffield, and reported to the Station as for sale by Horatio Lothrop of the same place, was analyzed with the following result:

| | |
|---|---|
| Phosphoric acid, | 37.84 |
| Cost per ton, | $19.00 |

Cost of phosphoric acid per pound, 2½ cts.

The sample was very fine, all of it passing through a sieve having $\frac{1}{50}$ inch meshes. Prolonged treatment with ammonium citrate dissolved only $4\frac{1}{2}$ per cent. of the phosphoric acid.

The phosphoric acid is therefore mostly "insoluble" but material as finely pulverized as this "Ground Phosphate Rock" might be often used to advantage where phosphates are deficient, especially on soils with abundant humus or decaying vegetable matter, as in case of reclaimed swamps, and where green-crops are plowed in, or on moist grass lands. At the price quoted it would also make a cheap and excellent superphosphate by treatment with oil of vitriol.

It was finally learned that this ground phosphate was not in the market, but was from a sample in the hands of an importer.

**783.** Phœnix Guano. Sold by W. C. Staples & Son, Westport. Sampled and sent by W. L. Coley, Westport.

ANALYSIS.

| | |
|---|---|
| "Reverted" phosphoric acid | 16.52 |
| Insoluble phosphoric acid | 6.52 |
| Cost per ton | $40.00 |
| Estimated value per ton | 33.65 |

Phœnix Guano from McKean's Island, like the Baker and Jarvis Islands, Curaçao, Orchilla and other guanos from rainy regions, has lost by atmospheric agency all or all but a trace of the nitrogen and potash which it originally contained. The phosphoric acid in them is much more readily soluble than in the rock phosphates, and on that account they are more active as fertilizers when applied to the land without previous treatment with oil of vitriol. Sample **783** was from a small stock remaining in possession of the dealer. The importations of Phœnix Guano are understood to have ceased some years ago.

## PLAIN (NON-NITROGENOUS) SUPERPHOSPHATES.

Four articles of this class have been examined within the year. The analyses and valuations of three of them will be found on page 26.

These are superphosphates in the true sense of the term, for essentially all the phosphate of lime which they contain is soluble in water. In such cases it is of little importance to the purchaser

whether the basis of the superphosphate is rock-phosphate or bone, while if, as is generally the case, from one-third to one-half or even more of the phosphoric acid in a superphosphate is insoluble, it will make a very considerable difference in the agricultural value of the article whether the insoluble portion consists of bone or rock. In many cases it is not easy for the chemist to decide with certainty what is the source of the phosphoric acid, and there is therefore wisdom and economy in providing soluble phosphoric acid in these high grade goods.

## Plain Superphosphates.

**735.** Superphosphate of Lime, 19 per cent. From stock of H. J. Baker & Bro., N. Y. Sampled and sent by J. J. Webb, Hamden.

**766.** Acid Phosphate of Lime, 14 per cent. available phosphoric acid. H. J. Baker & Bro., N. Y., wholesale dealers. Sampled from stock of Wilson & Burr, Middletown, by J. M. Hubbard, Middletown.

**779.** Dissolved Bone. Made by William L. Bradley, Boston. Sold by H. D. Torrey, Putnam. Sampled and sent by W. I. Bartholomew, Putnam.

| | 735 | 766 | 779 |
|---|---|---|---|
| Soluble phos. acid | 19.33 | 11.50 | 13.33 |
| Reverted phos. acid | .31 | 1.22 | 1.12 |
| Insoluble phos. acid, | .35 | .74 | 1.75 |
| Cost per ton, | $34.50* | $27.00 | $40.00 |
| Cost of soluble phos. acid per 100 lbs. | $ 8.67† | $10.40 | $13.46 |
| | $ 8.92‡ | $11.74 | $15.00 |

* In New York.

† Reckoning reverted and insoluble at 9 and 6 cents per pound respectively.

‡ Making no allowance for reverted and insoluble.

**735** contains a larger percentage of soluble phosphoric acid than any sample previously brought to the Station. Superphosphates are made containing 35 per cent. and over, but these are sold to manufacturers for use in mixed fertilizers, and have not found their way into our retail market.

The cost of soluble phosphoric acid per 100 pounds, making no allowance for the reverted and insoluble phosphoric acid is, in **735,**

$8.92, in **766,** $11.74, in **779,** $15.00. If reverted and insoluble phosphoric acid are valued at 9c. and 6c. per pound, the cost of soluble phosphoric acid will be $8.67, $10.40 and $13.46 per 100 pounds respectively. If we add $2.00 to the cost of **735,** to cover freight from New York, the hundred pounds of soluble phosphoric acid in it would cost $9.44 without taking account of the reverted and insoluble, or $9.18 making allowance for these.

It is evident, then, that soluble phosphoric acid can be bought without difficulty at retail for less than the present Station valuation, $12.50 per 100 pounds.

**799** is a sample of "Dissolved Bone Black," containing originally not far from 15 per cent. of soluble phosphoric acid, which has been treated with lime to "revert" the phosphoric acid for a particular use. It was sent to the Station for examination by Prof. H. P. Armsby of the Storrs Agricultural School. The analysis is as follows:

| | |
|---|---|
| Soluble phosphoric acid, | none |
| Reverted phosphoric acid, | 10.14 |
| Insoluble phosphoric acid, | .89 |

Wood ashes, leached or unleached, will revert superphosphates in the same way and the two should not be mixed if an application of soluble phosphate is desired.

In some sections of the country, purchasers much prefer to buy superphosphates which are dark colored or black. If there is any reason in such a whim it probably lies in the belief that such goods contain bone-black and that a superphosphate made from that material is more apt to be of high grade. The addition of a very little *lampblack* in the manufacture is a not uncommon practice, to gratify this prejudice.

## Nitrogenous, (Ammoniated) Superphosphates and Guanos.

This class includes all those commercial fertilizers—excepting the Special Fertilizers or "Formulas" to be noticed further on,—which contain or are claimed to contain any considerable amount of soluble phosphoric acid together with nitrogen. Potash is also found in most of them. Forty-nine samples of these goods have been tested. Sixteen were for private parties. The results of the other thirty-three analyses will be found tabulated on pages 28 to 31. 18 are called by the manufacturers, "Phos-

## Nitrogenous Superphosphates.

| Station No. | Name or Brand. | Manufacturer. | Dealer. | Sampled and Sent by |
|---|---|---|---|---|
| **752** | A. A. Ammoniated Superphosphate of Lime. | H. J. Baker & Bro., New York. | Wilcox & Judd, Bristol. | S. R. Gridley, Bristol. |
| **773** | Americus Brand Ammoniated Bone Superphosphate. | Williams, Clark & Co., New York. | O. F. Strunz, Bristol. | " " " |
| **791** | Phosphate. | G. H. Harris & Son, Eagleville, Ct. | Manufacturers. | W. H. Barrows, Willimantic. |
| **793** | Americus Brand Ammoniated Bone Superphosphate. | Williams, Clark & Co. | F. Ellsworth, Hartford. | L. S. Wells, New Britain. |
| **741** | Animal Fertilizer. | L. B. Darling & Co., Pawtucket, R.I. | J. P. Barstow & Co., Norwich. | J. P. Barstow, Norwich. |
| **792** | Dry Ground Fish. | Quin. Fertilizer Co., N. London, Ct. | Olds & Whipple, Hartford. | Olin Wheeler, Buckland. |
| **744** | Ammoniated Bone Superphosphate. | E. Frank Coe, New York. | J. P. Barstow & Co., Norwich. | J. P. Barstow, Norwich. |
| **720** | Superphosphate of Lime. | Bosworth Bros., Putnam, Ct. | Bosworth Bros., Putnam. | James Allen, Putnam. |
| **808** | Americus Ammoniated Bone Superphosphate. | Williams, Clark & Co. | O. F. Strunz, Bristol. | Station Agent. |
| **762** | Fish and Potash (second grade). | Quinnipiac Fertilizer Co. | S. A. Weldon & Son, Bristol. | S. R. Gridley, Bristol. |
| **726** | Phosphate. | " " " | R. B. Bradley & Co., N. Haven. | Station Agent. |
| **805** | A. A. Ammoniated Superphosphate. | H. J. Baker & Bro. | Wilcox & Judd, Bristol. | " " |
| **725** | Fish and Potash, Crossed Fish Brand. | Quinnipiac Fertilizer Co. | R. B. Bradley & Co., N. Haven. | " " |
| **790** | Phosphate. | Lombard & Matthewson, Warrenville, Ct. | Buck, Durkee & Stiles, Willimantic. | N. P. Perkins, Willimantic. |
| **829** | Fish and Potash. | Geo. W. Miles Co., Milford, Ct. | Olds & Whipple, Hartford. | Station Agent. |

## Nitrogenous Superphosphates—continued.

| Station No. | Name or Brand. | Manufacturer. | Dealer. | Sampled and Sent by |
|---|---|---|---|---|
| 749 | XL. Superphosphate. | Bradley Fertilizer Co., Boston. | H. K. Brainard, Thompsonville. | Station Agent. |
| 729 | Pelican Bone Phosphate. | H. J. Baker & Bro. | Dennis Fenn, Milford. | Dennis Fenn, Milford. |
| 747 | Fish and Potash (second grade). | Quinnipiac Fertilizer Co. | A. W. Allen, Jr., Thompsonville. | Station Agent. |
| 831 | Ammoniated Bone Superphosphate. | Russell Coe, Linden, N. J. | H. A. Stillman & Co., Hartford. | " " |
| 802 | Ammoniated Bone Superphosphate. | Preston & Sons, Greenpoint, L. I. | E. N. Pierce & Co., Plainville. | " " |
| 795 | Fish and Potash. | Bowker Fertilizer Co., New York and Boston. | W. F. Fuller, Suffield. | W. H. Pomeroy, Suffield. |
| 757 | Pelican Bone Phosphate. | H. J. Baker & Bro. | Wilcox & Judd, Coal and Lumber Co., Bristol. | S. R. Gridley. |
| 827 | Prepared Dry Fish. | Bowker Fertilizer Co. | Coburn & Gale, Hartford. | Station Agent. |
| 724 | Dry Ground Fish Guano. | Quinnipiac Fertilizer Co. | R. B. Bradley & Co., N. Haven. | " " |
| 803 | Dried and Ground Fish Guano. | Preston & Sons. | E. N. Pierce & Co., Plainville. | " " |
| 832 | Soluble Pacific Guano. | Pacific Guano Co., Boston, Mass. | H. A. Stillman & Co., Hartford. | " " |
| 737 | Fish and Potash, Crossed Fish Brand. | Quinnipiac Fertilizer Co. | A. W. Allen, Jr., Thompsonville. | C. T. Remington, Suffield. |
| 730 | A. A. Brand Phosphate. | H. J. Baker & Bro. | Dennis Fenn, Milford. | Dennis Fenn. |
| 755 | Brighton Phosphate. | Bowker Fertilizer Co. | S. A. Weldon & Son, Bristol. | S. R. Gridley. |
| 750 | Pine Island Guano. | Quinnipiac Fertilizer Co. | A. W. Allen, Jr., Thompsonville. | Station Agent. |
| 833 | I.X.L. Ammon. Bone Superphos. | Geo. W. Miles Co. | Olds & Whipple, Hartford. | " " |
| 828 | Cooke's Blood Guano. | Bowker Fertilizer Co. | A. C. Sternberg, Hartford. | " " |
| 763 | Powell's Prepared Chemicals. | Brown Chemical Co., Baltimore. | | S. R. Gridley. |

## Nitrogenous Superphosphates.

| Station No. | Name. | Nitrogen of Nitrates. | Nitrogen of Ammonia Salts. | Nitrogen of Organic Matters. | Soluble Phos. Acid. | Reverted Phos. Acid. | Insoluble Phos. Acid. | Potash. | Chlorine. | Estimated value per ton. | Cost per ton. | Valuation exceeds Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 752 | H. J. Baker & Bro's A. A. Ammoniated Superphosphate of Lime | -- | -- | 3.29 | 8.41 | 1.45 | .62 | 3.29 | -- | $50.23 | $42.00 | $8.23 |
| 773 | Williams, Clark & Co's Americus Brand Ammoniated Bone Superphos. | -- | -- | 2.90 | 10.82 | .92 | 1.05 | 2.82 | 1.91 | 46.71 | 40.00 | 6.71 |
| 791 | Geo. H. Harris & Son's Phosphate | -- | -- | 3.08 | 4.43 | 6.26 | 3.81 | .35 | 4.00 | 42.81 | *37.00 | 5.81 |
| 793 | Williams, Clark & Co's Americus Brand Ammoniated Bone Superphos. | -- | -- | 2.81 | 9.13 | 1.02 | .63 | 2.95 | 2.26 | 41.87 | §38.00 | 3.87 |
| 711 | Darling's Animal Fertilizer | -- | -- | 4.20 | .70 | 7.46 | 5.11 | 5.95 | 5.76 | 47.41 | ‡45.00 | 2.41 |
| 792 | Quinnipiac Fertilizer Co's Dry Ground Fish | 1.45 | -- | 5.59 | 1.52 | 4.58 | 2.62 | 2.69 | 3.19 | 52.24 | 50.00 | 2.24 |
| 741 | E. Frank Coe's Ammoniated Bone Superphosphate | -- | -- | 2.63 | 8.11 | 1.34 | 2.80 | -- | -- | 38.67 | 37.00 | 1.67 |
| 720 | Bosworth Bros' Superphosphate of Lime | -- | -- | 2.10 | 5.50 | 1.61 | 4.17 | 2.23 | -- | 39.36 | *38.00 | 1.36 |
| 808 | Williams, Clark & Co's Americus Brand Ammoniated Bone Superphos | -- | -- | 2.50 | 9.79 | .71 | .77 | 2.42 | 1.45 | 41.10 | 40.00 | 1.10 |
| 762 | Quinnipiac Fertilizer Co's Fish and Potash (second grade) | .20 | -- | 2.72 | .27 | 4.83 | 4.96 | 4.75 | 6.60 | 33.17 | 33.00 | .17 |
| | | | | | | | | | | | | Cost exceeds Valuation. |
| 726 | Quinnipiac Fertilizer Co's Phosphate | 1.62 | -- | 1.38 | 5.43 | 2.76 | 2.91 | 2.35 | 4.60 | 39.43 | 40.00 | .57 |
| 805 | H. J. Baker & Bro's A. A. Ammoniated Superphosphate | -- | 1.16 | 1.51 | 8.30 | 1.58 | .52 | 3.04 | 3.03 | 41.23 | 42.00 | .77 |
| 725 | Quinnipiac Fertilizer Co's Fish and Potash, Crossed Fish Brand | 1.64 | -- | 2.42 | .80 | 3.17 | 4.13 | 4.19 | 8.61 | 37.00 | 38.00 | 1.00 |
| 790 | Lombard & Matthewson's Phosphate | -- | -- | 2.46 | 4.34 | 8.08 | .69 | .26 | 4.57 | 38.43 | ‖40.00 | 1.58 |
| 829 | Geo. W. Miles Co's Fish and Potash | -- | .46 | 3.43 | 4.08 | 1.24 | 1.86 | 1.31 | 4.25 | 38.10 | 40.00 | 1.90 |
| 749 | Bradley Fertilizer Co's XL. Superphosphate | -- | -- | 2.67 | 8.33 | 1.38 | 1.75 | 1.71 | 1.77 | 39.97 | 42.00 | 2.03 |

* In bulk. § In New York. ‡ Figured from cost per bag, viz: $3.75 for 167 lbs. ‖ In bags.

## NITROGENOUS SUPERPHOSPHATES—CONTINUED.

| Station No. | Name. | Nitrogen of Nitrates. | Nitrogen of Ammonia Salts. | Nitrogen of Organic Matters. | Soluble Phos. Acid. | Reverted Phos. Acid. | Insoluble Phos. Acid. | Potash. | Chlorine. | Estimated value per ton. | Cost per ton. | Cost exceeds Valuation. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 729 | H. J. Baker & Bro's Pelican Bone Phosphate | .94 | -- | 1.48 | 6.35 | 2.21 | .73 | 2.87 | 4.51 | 35.60 | 38.00 | 2.40 |
| 747 | Quinnipiac Fertilizer Co's Fish and Potash (second grade) | -- | -- | 2.84 | .15 | 4.59 | 5.23 | 4.93 | 9.08 | 33.48 | 36.00 | 2.52 |
| 831 | Russell Coe's Ammoniated Bone Superphosphate | -- | -- | 2.10 | 8.08 | 1.88 | 1.82 | 1.41 | 2.48 | 37.25 | 40.00 | 2.75 |
| 802 | Preston & Sons' Ammoniated Bone Superphosphate | -- | -- | 2.36 | 7.06 | 1.79 | 3.53 | -- | -- | 36.44 | 40.00 | 3.56 |
| 795 | Bowker Fertilizer Co's Fish and Potash | -- | -- | 2.18 | 4.11 | 1.19 | 2.16 | 5.41 | 10.54 | 30.91 | 35.00 | 4.09 |
| 757 | H. J. Baker & Bro's Pelican Bone Phosphate | .98 | -- | 1.57 | 6.16 | 2.07 | .63 | 2.32 | 3.93 | 35.60 | 40.00 | 4.40 |
| 827 | Bowker Fertilizer Co's Prepared Dry Fish | -- | -- | 3.75 | 1.05 | 5.85 | 3.67 | -- | -- | 35.56 | 40.00 | 4.44 |
| 724 | Quinnipiac Fertilizer Co's Dry Ground Fish Guano | -- | -- | 5.11 | .48 | 5.18 | 4.16 | 2.50 | 5.15 | 43.51 | 48.00 | 4.46 |
| 803 | Preston & Sons' Dried and Ground Fish Guano | .39 | 1.21 | 1.95 | 2.23 | 3.25 | .52 | -- | -- | 30.46 | 35.00 | 4.54 |
| 832 | Soluble Pacific Guano | .75 | -- | 1.56 | 6.19 | 1.91 | 4.88 | 3.11 | 2.62 | 39.28 | 45.00 | 5.72 |
| 737 | Quinnipiac Fertilizer Co's Fish and Potash, Crossed Fish Brand | .53 | -- | 3.01 | .43 | 4.06 | 3.58 | 3.97 | 8.15 | 33.87 | 40.00 | 6.23 |
| 730 | H. J. Baker & Bro's A. A. Brand Phosphate | -- | -- | 3.14 | 6.57 | 2.45 | .55 | 2.15 | 2.22 | 38.71 | 45.00 | 6.29 |
| 755 | Bowker Fertilizer Co's Brighton Phosphate | -- | -- | 2.00 | 1.88 | 2.38 | 4.19 | 1.63 | -- | 33.10 | 40.00 | 6.90 |
| 750 | Quinnipiac Fertilizer Co's Pine Island Guano | 1.80 | -- | 2.72 | 1.61 | 3.95 | 3.90 | 3.41 | -- | 42.08 | 50.00 | 7.92 |
| 833 | Geo. W. Miles Co's I. X. L. Ammoniated Bone Superphosphate | -- | -- | 1.70 | 7.71 | .90 | 2.18 | 1.90 | 1.68 | 33.58 | 42.00 | 8.42 |
| 828 | Bowker Fertilizer Co., Cooke's Blood Guano | -- | -- | 1.88 | 4.11 | 2.83 | 1.26 | 1.51 | 2.12 | 31.04 | 42.50 | 11.46 |
| 763 | Brown Chemical Co's Prepared Chemicals | -- | -- | 1.76 | 3.83 | .90 | 1.62 | 8.78 | 6.90 | 30.37 | †46.15 | 15.78 |
| | Average 32 Samples | -- | -- | -- | -- | -- | -- | -- | -- | 38.69 | 40.58 | ---- |

† Figured from cost per bbl., viz: $6.00 for 260 lbs.

phates or Superphosphates," 6, "Fish and Potash," and 3 "Ground Fish Guano." The other six are "Prepared Dry Fish," "Soluble Pacific Guano," "Pine Island Guano," "Blood Guano," "Animal Fertilizer," and "Prepared Chemicals."

The last named, No. **763**, is advertised as follows:* "For \$12 a farmer can buy a formula (520 lbs.) of POWELL'S PREPARED CHEMICALS. This, when mixed at home, makes one ton of SUPERIOR PHOSPHATE, equal in plant-life and as certain of successful crop-production as many high-priced phosphates." A device, resembling a trade mark, bears the words, "Purity." "Quality not quantity."

This is a superphosphate of rather low grade; its cost is \$46.15 per ton and its estimated value \$30.37. 520 lbs. of it "mixed at home" would require the addition of 1480 lbs. of something better than itself to make "one ton of superior phosphate." It was sampled by Mr. Gridley of Bristol from a lot purchased by a farmer in that place. We do not understand that the goods are at present offered for sale in this State.

It will be observed that during 1882 nitrates have been considerably used as a source of nitrogen both in the superphosphates and special manures. During the last 18 months the nitrogen of Chili saltpeter has ruled cheaper than that of dried blood, azotin, ammonite, fish scrap, etc., so that manufacturers have made use of it more frequently than in past years.

Chlorine has been determined in most cases in order to decide whether the potash in the fertilizer exists as muriate or sulphate. High grade sulphate contains none or only very little chlorine, the double sulphate of potash and magnesia, which has now come into considerable use in this country, has only from one to four per cent. of chlorine while muriate of potash (80 per cent.) has 38 or more per cent.

The table giving a Comparison of Different Fertilizers of the same Brand, p. 33, makes evident the variations which may arise from want of uniformity in the materials employed in the manufacture, accidents or carelessness in the preparation of the fertilizer, the storage of the goods, errors in sampling, etc., etc.

We are informed by the manufacturers that the regular price of the Quinnipiac Fertilizer Co's Fish and Potash No. 1, is \$38.00, and that **737** (price \$40.00) was from a special lot of which only two tons were made.

* Cover of the American Agriculturist, Jan., 1882.

## Comparison of Different Superphosphates of the same Brand.

| Station No. | Name or Brand. | Nitrogen of Nitrates. | Nitrogen of Ammonia Salts. | Nitrogen of Organic Matters. | Soluble Phos. Acid. | Reverted Phos. Acid. | Insoluble Phos. Acid. | Potash. | Chlorine. |
|---|---|---|---|---|---|---|---|---|---|
| 752 | H. J. Baker & Bro's Ammoniated Superphosphate | | | 3.29 | 8.14 | 1.45 | .62 | 3.29 | |
| 805 | | | 1.16 | 1.51 | 8.30 | 1.58 | .52 | 3.04 | 3.03 |
| 730 | | | | 3.14 | 6.57 | 2.45 | .55 | 2.15 | 2.22 |
| 729 | H. J. Baker & Bro's Pelican Bone Phosphate | .94 | | 1.48 | 6.35 | 2.21 | .73 | 2.87 | 4.51 |
| 757 | | .98 | | 1.57 | 6.46 | 2.07 | .63 | 2.32 | 3.93 |
| 792 | Quinnipiac Fertilizer Co's Dry Ground Fish Guano | 1.45 | | 5.59 | 1.52 | 4.58 | 2.62 | 2.69 | 3.19 |
| 724 | | | | 5.11 | .48 | 5.18 | 4.16 | 2.50 | 5.15 |
| 725 | Quin. Fertilizer Co's Fish and Potash, Crossed Fish Brand | 1.64 | | 2.42 | .80 | 3.17 | 4.13 | 4.19 | 8.61 |
| 737 | | .53 | | 3.01 | .43 | 4.06 | 3.58 | 3.97 | 8.15 |
| 762 | Quinnipiac Fertilizer Co's Fish and Potash, Second Grade | .20 | | 2.72 | .27 | 4.83 | 4.96 | 4.75 | 6.60 |
| 747 | | | | 2.84 | .15 | 4.59 | 5.23 | 4.93 | 9.08 |

## Special Fertilizers.

| Station No. | Name or Brand. | Manufacturer. | Dealer. | Sampled and Sent by |
|---|---|---|---|---|
| 820 | Corn Manure. | Geo. B. Forrester, New York. | ---------- | S. B. Wakeman, Saugatuck. |
| 821 | Onion " | " " " | ---------- | " " " |
| 789 | Corn " | Mapes' F. & P. G. Co., New York. | Mapes' F.& P.G.Co's Br'ch,Hart. | C. H. Pease, South Windsor. |
| 767 | Tobacco " (for use with stems). | " " " " | P. M. Augur & Sons, Middlefield. | J. M. Hubbard, Middletown. |
| 787 | " " " " | " " " " | Mapes Co's Branch, Hartford. | C. H. Pease. |
| 815 | Corn " | " " " " | P. M. Augur & Sons. | P. M. Augur. |
| 822 | Potato " | Geo. B. Forrester. | ---------- | S. B. Wakeman. |
| 816 | Orange Tree Manure. | Mapes' F. & P. G. Co. | P. M. Augur & Sons. | P. M. Augur. |
| 788 | Tobacco Manure, Connecticut Brand. | " " " | Mapes Co's Branch, Hartford. | C. H. Pease. |
| 760 | Corn Manure. | H. J. Baker & Bro., New York. | Wilcox & Judd, Bristol. | S. R. Gridley. |
| 782 | Complete Corn Manure. | " " " " | Olds & Whipple, Hartford. | Olin Wheeler, Buckland. |
| 814 | Potato Manure. | Mapes' F. & P. G. Co. | P. M. Augur & Sons. | P. M. Augur. |
| 807 | " " | H. J. Baker & Bro. | Wilcox & Judd, Bristol. | Station Agent. |
| 806 | Corn " | " " " | " " " | " " |
| 761 | Stockbridge Manure for Corn & Grain. | Bowker Fertilizer Co. | S. A. Weldon & Son, Bristol. | S. R. Gridley, Bristol. |
| 738 | " Grass, Top Dressing. | " " " | J. P. Barstow & Co., Norwich. | J. P. Barstow, Norwich. |
| 756 | " Man. for Pot. and Veg. | " " " | S. A. Weldon & Son, Bristol. | S. R. Gridley. |
| 810 | " Manure for Grain. | " " " | " " " " | Station Agent. |
| 781 | Potato Manure. | H. J. Baker & Bro. | Olds & Whipple, Hartford. | J. F. Phelps, Bloomfield. |
| 780 | Complete Tobacco Manure. | " " " | " " " | Olin Wheeler. |
| 740 | Stockbridge Man. for Pot. and Veg. | Bowker Fertilizer Co. | J. P. Barstow & Co., Norwich. | J. P. Barstow. |
| 739 | " Man. for Corn and Grain. | " " " | " " " " | " " |
| 830 | Patent Fertilizer for Tobacco. | Bradley Fertilizer Co., Boston. | A. C. Sternberg, Hartford. | Station Agent. |

## Special Fertilizers.

| Station No. | Name. | Nitrogen of Nitrates. | Nitrog. of Ammonia Salts. | Nitrog. of Organic Matters | Total Nitrogen. | Soluble Phos. Acid. | Reverted Phos. Acid. | Insoluble Phos. Acid. | Potash. | Chlorine. | Estimated value per ton. | Cost per ton. | Valuation exceeds Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 820 | Corn Manure, Forrester's | ---- | 5.09 | .21 | 5.30 | 6.94 | .84 | .78 | 8.06 | 6.39 | $58.39 | *50.00 | $8.39 |
| 821 | Onion " " | ---- | 5.53 | ---- | 5.53 | 5.93 | .30 | .40 | 5.69 | .66 | 55.53 | *50.00 | 5.53 |
| 789 | Corn " Mapes' | 1.00 | 2.36 | .17 | 3.53 | 7.88 | 3.78 | 1.25 | 7.17 | 6.29 | 54.86 | 50.00 | 4.86 |
| 767 | Tobacco " (for use with stems). Mapes' | 2.60 | 2.35 | .91 | 5.86 | 3.40 | 4.12 | 2.30 | 4.36 | 1.24 | 56.30 | 54.00 | 2.30 |
| 787 | " " " " " | 2.48 | 2.46 | .66 | 5.60 | 4.76 | 2.77 | 2.14 | 4.37 | .28 | 55.92 | 54.00 | 1.92 |
| 815 | Corn " Mapes' | 1.44 | 1.71 | .87 | 4.02 | 4.93 | 4.67 | 2.15 | 6.91 | 7.45 | 51.82 | 50.00 | 1.82 |
| 822 | Potato " Forrester's | ---- | 3.78 | ---- | 3.78 | 5.98 | .93 | .31 | 10.27 | 4.90 | 50.69 | 50.00 | .69 |
| | | | | | | | | | | | | | Cost exceeds Valuation. |
| 816 | Orange Tree Manure, Mapes' | 2.22 | ---- | 1.18 | 3.40 | 2.85 | 4.60 | 2.53 | 3.77 | 1.14 | 40.93 | 42.00 | 1.07 |
| 788 | Tobacco Manure, Conn. Brand, Mapes' | 1.52 | 1.68 | .42 | 3.62 | 5.44 | 2.33 | 1.64 | 9.03 | 1.72 | 52.05 | 54.00 | 1.95 |
| 760 | Corn Manure, Baker's | ---- | ---- | 4.95 | 4.95 | 4.54 | .89 | .19 | 9.51 | ---- | 46.45 | 50.00 | 3.55 |
| 782 | " " | 1.66 | 1.96 | .83 | 4.45 | 5.34 | .31 | .20 | 7.95 | 5.61 | 46.08 | 50.00 | 3.92 |
| 814 | Potato Manure, Mapes' | 1.46 | 1.30 | 1.18 | 3.94 | 3.25 | 4.61 | 2.18 | 6.10 | 4.88 | 45.94 | 51.00 | 5.06 |
| 807 | " " Baker's | ---- | 3.00 | 1.15 | 4.15 | 4.88 | .14 | .10 | 9.37 | 12.15 | 44.86 | 50.00 | 5.14 |
| 806 | Corn " " | 1.62 | 1.93 | .61 | 4.16 | 4.42 | 1.34 | .43 | 7.97 | 9.68 | 44.49 | 50.00 | 5.51 |
| 761 | Corn and Grain Manure, Stockbridge | 1.35 | ---- | 2.49 | 3.84 | 5.02 | 1.35 | 2.76 | 6.64 | 6.02 | 43.90 | 50.00 | 6.10 |
| 738 | Grass Top Dressing, " | 1.59 | ---- | 2.46 | 4.05 | 6.10 | .62 | 2.77 | 3.69 | 3.14 | 43.46 | 50.00 | 6.54 |
| 756 | Potato and Vegetable Manure, Stockbridge | .88 | ---- | 2.67 | 3.55 | 5.40 | 1.95 | 2.65 | 4.85 | 5.03 | 42.44 | 50.00 | 7.56 |
| 810 | Grain Manure, Stockbridge | 1.05 | .13 | 2.30 | 3.48 | 4.85 | 1.72 | 2.57 | 6.83 | 6.62 | 42.39 | 50.00 | 7.61 |
| 781 | Potato " Baker's | ---- | 2.61 | .96 | 3.57 | 4.66 | .22 | .05 | 9.99 | 11.13 | 41.87 | 50.00 | 8.13 |
| 780 | Complete Tobacco Manure, Baker's | 1.09 | 3.30 | .35 | 4.76 | 2.48 | .18 | .02 | 8.56 | 9.98 | 41.60 | 50.00 | 8.40 |
| 740 | Potato and Vegetable Manure, Stockbridge | .70 | ---- | 2.56 | 3.26 | 6.02 | 1.58 | 2.31 | 4.95 | 4.62 | 41.54 | 50.00 | 8.46 |
| 739 | Corn and Grain " " | .67 | ---- | 3.15 | 3.82 | 6.29 | 1.12 | 1.03 | 3.87 | 3.53 | 41.46 | 50.00 | 8.54 |
| 830 | Patent Fertilizer for Tobacco, Bradley's | .56 | ---- | 2.08 | 2.64 | 7.00 | 1.31 | 1.51 | 1.90 | 2.11 | 36.46 | 50.00 | 13.54 |
| | Average 23 Analyses | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 46.93 | 50.22 | ---- |

* In New York.

Rejecting **763**, the average estimated value of the other 32 nitrogenous superphosphates this year has been $38.69 and the average cost $40.58; a difference in round numbers of $2.00.

In 1881 the average cost, $43.00, exceeded the average estimated value by $4.00, and in 1880 the average cost was $39.00, $3.00 more than the estimated value.

## Special Fertilizers or "Formulas."

On pages 34 and 35 will be found the analyses and valuations of 23 samples of these fertilizers. In 10 of the number nitrogen is present in three forms, as nitrates, ammonia, and in animal or vegetable matter ("organic nitrogen.")

In Mapes' Tobacco manures, (Connecticut brand, and for use with stems) Nos. 767, 787, and 788 and in Forrester's Onion Manure No. 821, most of the potash is present as sulphate.

The estimated value of two articles of this class is very considerably higher than their market price, in nine of them estimated value and cost differ less than $5.00, while in the remaining 12 the cost is a good deal higher than the estimated value.

The *average* cost is $50.22; $3.29 more than the average estimated value $46.93. In 1881 the average cost $48.40 exceeded the estimated value by $4.80, and in 1880 the average cost, $48.00, exceeded the estimated value by $3.35.

On the following page is a comparison of the various corn, tobacco and potato manures.

The average composition of these manures is as follows:

| | Nitrogen. | Phosphoric Acid. | Potash. |
|---|---|---|---|
| Corn manure, | 4.32 | 8.93 | 7.34 |
| Tobacco manure, | 3.67 | 7.30 | 6.49 |
| Potato manure, | 3.74 | 8.06 | 6.37 |

The tobacco and potato manures—on the average—agree in composition more closely than separate analyses of the same brand of goods usually do.

An examination of these analyses and those of special fertilizers made in past years, abundantly justifies the conclusion that on the farms of this State it is quite as rational to use a "Corn manure" on potato land or a "potato manure" for the tobacco crop, as in any other way. To attempt to construct a fertilizer specially adapted to growing a particular crop on soils which

differ so widely in composition and have been so differently fertilized and tilled as those of Connecticut is irrational and useless. Objection to these goods only applies to their names and to the theory on which they are made and on which their special claims rest. As *fertilizers* they are of good quality; their higher retail price, compared with that of other superphosphates is in part justified by the larger amounts of nitrogen and potash which they usually contain.

COMPARISON OF SPECIAL MANURES.

| | Brand. | | Total Nitrogen. | Soluble Phos. Acid. | Reverted Phos. Acid. | Insoluble Phos. Acid. | Potash | Chlorine. |
|---|---|---|---|---|---|---|---|---|
| Corn Manure | Forrester's, | 1 Analysis | 5.30 | 6.94 | .84 | .78 | 8.06 | 6.39 |
| | Mapes', | 2 Analyses | 3.77 | 6.40 | 4.23 | 1.70 | 7.04 | 6.87 |
| | Baker's, | 3 " | 4.52 | 4.77 | .85 | .27 | 8.48 | 7.64 |
| | Stockbridge, | 3 " | 3.71 | 5.39 | 1.43 | 2.12 | 5.78 | 5.39 |
| Tobacco Manure | Mapes', | 1 Analysis | 3.62 | 5.44 | 2.33 | 1.64 | 9.03 | 1.72 |
| | Baker's, | 1 " | 4.76 | 2.48 | .18 | .02 | 8.56 | 9.98 |
| | Bradley's, | 1 " | 2.64 | 7.00 | 1.31 | 1.51 | 1.90 | 2.11 |
| Potato Manure | Forrester's, | 1 Analysis | 3.78 | 5.98 | .93 | .31 | 10.27 | 4.90 |
| | Mapes', | 1 " | 3.94 | 3.25 | 4.61 | 2.18 | 6.10 | 4.88 |
| | Baker's, | 2 Analyses | 3.86 | 4.77 | .18 | .07 | 9.68 | 11.64 |
| | Stockbridge, | 2 " | 3.40 | 5.71 | 1.76 | 2.48 | 4.90 | 4.82 |

## BONE MANURES.

### *Method of Valuation.*

For the benefit of those who have not the previous reports of the Station at hand, a detailed account of the method employed for the valuation of bone manures is here given, being in large part reproduced from former Reports.

Experience has led us to distinguish, for the purpose of valuation, five grades of ground bone, the proportions of which are found by a mechanical analysis, *i. e.*, by passing a weighed sample of the bone through a system of four sieves. These five grades have the dimensions, and during 1882, have had the trade-values below specified, viz:

| Grade. | Dimensions. | 1882. Estimated value per pound. Nitrogen. | Phos. Acid. |
|---|---|---|---|
| Fine, | smaller than one $\frac{1}{50}$ inch, | 17 cts. | 6 cts. |
| Fine medium, | between $\frac{1}{50}$ and $\frac{1}{25}$ inch, | 15 " | $5\frac{1}{2}$ " |
| Medium, | " $\frac{1}{25}$ and $\frac{1}{12}$ inch, | 14 " | 5 " |
| Coarse medium, | " $\frac{1}{12}$ and $\frac{1}{6}$ inch, | 13 " | $4\frac{1}{2}$ " |
| Coarse, | larger than $\frac{1}{6}$ inch, | 11 " | 4 " |

The chemical and mechanical analysis of a sample of ground bone being before us, we separately compute the nitrogen value of each grade of bone which the sample contains, by multiplying the pounds of nitrogen per ton in the sample by the per cent. of each grade, taking $\frac{1}{100}$th of that product, multiplying it by the estimated value per pound of nitrogen in that grade, and taking this final product as the result in cents. Summing up the separate values of each grade, thus obtained, together with the values of each grade for phosphoric acid, similarly computed, the total is the estimated value of the sample of bone.

The following example will serve for illustration. Rogers and Hubbard's Pure Ground Bone, **818**, contains nitrogen 3.94 per cent., or 78.8 pounds per ton; phosphoric acid 22.50 per cent., or 450 pounds per ton. The mechanical analysis showed:

| | | |
|---|---|---|
| 31 | per cent. | fine. |
| 25 | " | fine medium. |
| 23 | " | medium. |
| 21 | " | coarse medium. |
| 0 | " | coarse. |
| 100 | | |

The calculations are as follows:

| | |
|---|---|
| $78.8 \times 31 \div 100 \times 17 =$ | $4.16 |
| $78.8 \times 25 \div 100 \times 15 =$ | 2.96 |
| $78.8 \times 23 \div 100 \times 14 =$ | 2.54 |
| $78.8 \times 21 \div 100 \times 13 =$ | 2.15 |
| Estimated value of nitrogen, | $11.81 |
| $450 \times 31 \div 100 \times 6 =$ | $8.37 |
| $450 \times 25 \div 100 \times 5\frac{1}{2} =$ | 6.19 |
| $450 \times 23 \div 100 \times 5 =$ | 5.18 |
| $450 \times 21 \div 100 \times 4\frac{1}{2} =$ | 4.25 |
| Estimated value of phosphoric acid, | $23.99 |
| | $35.80 |

The result agrees with the cost ($35.00) within 80 cents.

When the sample of bone contains foreign matters introduced as preservatives, dryers or adulterants, such as salt, salt-cake, niter-cake, ground oyster-shells, spent lime, plaster, or soil, these must be taken account of in the mechanical analysis, especially since they would be likely, on sifting, to pass chiefly or entirely

into the finer grades. In such cases, the several grades as obtained by sifting must be separately examined, and the amounts of foreign matter which they contain must be suitably taken into the account if an *exact* valuation is desired.

In some instances a further source of error in valuation may arise from the fact that the proportions of nitrogen and phosphoric acid are not the same in the finer and coarser portions of a sample, which contains no adulterants, properly speaking, but partly consists of meat, tendon, etc.

There is, however, a limit beyond which it is useless to attempt to refine the processes of valuation. When they become too complicated or costly they defeat the object which they should serve. It is sufficient that the errors of valuation are no greater than those which arise from unavoidable variations in different portions of the same lot of fertilizer, or in different lots of the same brand. A difference of two or three dollars between cost and estimated value cannot ordinarily demonstrate that either is out of the way.

## Bone Manures.

### *Analyses.*

[See pages 40 and 41.]

Sample **733** was very wet, which accounts for the low percentage of nitrogen and phosphoric acid found in it. At the price asked ($25.00 per ton) it is an excellent article for immediate use, but in its moist state could not be kept long without decomposition and loss.

In five of the samples analyzed this year the valuations fall very considerably below the market price. In **731** and **804** this is caused chiefly by the coarseness of the bone. **770** contains salt-cake in considerable quantity, as this brand of goods usually does. **801** probably contains the same. **751** has 6.9 per cent. of sulphuric acid combined with lime, being equivalent to 13.3 per cent. of hydrated plaster.

Salt-cake is used as a drier and preservative to mix with bone which would otherwise be too wet to handle and transport. No secret is made of it by the manufacturers, nor is the mixture sold as "pure" bone. But bone sold as "pure" which contains 13 per cent. of land plaster has clearly been adulterated.

The average cost of bone this year, $35.29, exceeds the average estimated value, $32.14, by $3.15.

## Bone Manures—Analyses and Valuations.

| Station No. | Name. | Nitrogen. | Phos. Acid. | Finer than 1/50 inch. | Finer than 1/25 inch. | Finer than 1/12 inch. | Finer than 1/6 inch. | Coarser than 1/6 inch. | Estimated value per ton. | Cost per ton. | Valuation exceeds Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **711** | Bone Sawings | 3.86 | 26.98 | 97 | 3 | ---- | ---- | ---- | $45.37 | *40.00 | $5.37 |
| **764** | Williams. Clark & Co's Bone Meal | 3.76 | 21.22 | 61 | 22 | 15 | 2 | ---- | 36.28 | 32.00 | 4.28 |
| **733** | Rogers & Hubbard Co's Bone Sawings | 2.10 | 16.50 | 100 | ---- | ---- | ---- | ---- | 26.94 | 25.00 | 1.94 |
| **732** | " " " " Meal | 3.94 | 23.66 | 40 | 35 | 25 | ---- | ---- | 38.63 | 37.50 | 1.13 |
| **771** | Mapes' Extra Fine, Strictly Pure Ground Bone | 2.49 | 28.87 | 52 | 40 | 8 | ---- | ---- | 40.98 | 40.00 | .98 |
| **818** | Rogers & Hubbard Co's Pure Ground Bone, Grade AX | 3.94 | 22.50 | 31 | 25 | 23 | 21 | ---- | 35.80 | 35.00 | .80 |
| | | | | | | | | | | | Cost exceeds Valuation. |
| **§677** | Peck Brothers' Ground Bone | 4.32 | 21.89 | 7 | 14 | 17 | 33 | 29 | 31.95 | 32.00 | ---- |
| **824** | Geo. B. Forrester's Pure Ground Bone | 3.40 | 21.95 | 42 | 19 | 21 | 16 | 2 | 34.13 | †36.00 | 1.87 |
| **794** | Williams, Clark & Co's Americus Bone Meal | 3.14 | 22.54 | 59 | 18 | 16 | 7 | ---- | 35.43 | †38.00 | 2.57 |
| **743** | Rogers & Hubbard Co's "A" Bone | 3.94 | 24.47 | 10 | 13 | 31 | 46 | ---- | 35.16 | 38.00 | 2.84 |
| **712** | Darling's Fine Bone | 3.82 | 22.71 | 73 | 21 | 6 | ---- | ---- | 39.02 | 42.00 | 2.98 |
| **839** | Richards' Pure Bone | 4.08 | 20.55 | 14 | 21 | 24 | 31 | 10 | 31.94 | 35.00 | 3.06 |
| **753** | Peck Brothers' Ground Bone | 4.04 | 21.77 | 6 | 9 | 30 | 46 | 9 | 31.77 | 35.00 | 3.23 |
| **770** | Lister Brothers' Celebrated Ground Bone | 3.22 | 14.48 | 42 | 19 | 14 | 14 | 11 | 25.10 | 31.00 | 5.90 |
| **731** | H. J. Baker & Bro's Pure Ground Bone | 3.65 | 23.83 | 10 | 16 | 35 | 38 | 1 | 33.99 | 40.00 | 6.01 |
| **804** | Richardson's Ground Bone | 3.54 | 16.35 | 6 | 20 | 29 | 29 | 16 | 25.51 | 33.00 | 7.49 |
| **751** | Pure Ground Bone | 2.84 | 14.33 | 41 | 23 | 23 | 10 | 3 | 24.27 | 34.00 | 9.73 |
| **§670** | Rafferty & Williams' Bone Meal | 1.68 | 14.36 | 52 | 20 | 14 | 14 | ---- | 21.19 | 32.00 | ---- |
| **801** | Preston & Sons' Ground Bone | 1.94 | 10.47 | 43 | 21 | 15 | 12 | 9 | 17.12 | 35.00 | 17.88 |
| **817** | Rogers & Hubbard Co's Marine Bone | 4.61 | 22.89 | 33 | 55 | 12 | ---- | ---- | 39.99 | ‡ | ---- |
| | Average 19 Analyses | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 32.14 | 35.29 | ---- |

§ The analyses of **670** and **677**, made late in 1881, were in the last Station Report, with valuations reckoned from the trade values adopted for last year. The advance in cost of nitrogenous raw-materials having necessitated changes in the Station scale of trade values, these analyses are here given with valuations calculated by the trade-values of 1882.

* In bbls. net. † In New York. ‡ Price not fixed.

## Bone Manures.

| Station No. | Name or Brand. | Manufacturer. | Dealer. | Sampled and Sent by |
|---|---|---|---|---|
| 711 | Bone Sawings. | ---------- | Wilder & Puffer, Springfield. | R. E. Pinney, Suffield, Ct. |
| 764 | Bone Meal. | Williams, Clark & Co., New York. | S. A. Weldon & Son, Bristol. | S. R. Gridley, Bristol. |
| 733 | Bone Sawings. | Rogers & Hubbard Co., Middleto'n | Manufacturers. | P. M. Augur, Middlefield, Ct. |
| 732 | Bone Meal. | " " " " | " | " " " " |
| 771 | Extra Fine, Strictly Pure Ground Bone. | Mapes' Formula and Peruvian Guano Co., New York. | W. H. Smith, Norwalk, Ct. | D. H. Van Hoosear, Wilton, Ct. |
| 818 | Pure Ground Bone, Grade AX. | Rogers & Hubbard Co. | Manufacturers. | Chas. Fairchild, Middletown, Ct. |
| 677 | Ground Bone. | Peck Bros., Northfield, Ct. | G. P. Burnett. Bristol. | S. R. Gridley, Nov. 9, 1881. |
| 824 | Pure Ground Bone. | Geo. B. Forrester, New York. | ---------- | S. B. Wakeman, Saugatuck, Ct. |
| 791 | Americus Bone Meal. | Williams, Clark & Co. | F. Ellsworth, Hartford, Ct. | L. S. Wells, New Britain, Ct. |
| 743 | "A" Bone. | Rogers & Hubbard Co. | ---------- | J. P. Barstow, Norwich, Ct. |
| 742 | Darling's Fine Bone. | L. B. Darling & Co., Pawtucket, R. I. | J. P. Barstow & Co., Norwich. | " " " " |
| 839 | Richards' Pure Bone. | Geo. Richards & Co., Unionville. | Manufacturers. | Wm. Porter, Unionville. |
| 753 | Ground Bone. | Peck Bros., Northfield. | G. Perry Bennett, Bristol, Ct. | S. R. Gridley. |
| 770 | Celebrated Ground Bone. | Lister Bros., Newark, N. J. | Manufacturers. | D. H. Van Hoosear, Wilton. |
| 731 | Pure Ground Bone. | H. J. Baker & Bro., New York. | Dennis Fenn, Milford. | Dennis Fenn. |
| 804 | Ground Bone. | Geo. Richardson & Son, Unionville | E. N. Pierce & Co., Plainville. | Station Agent. |
| 751 | Pure Ground Bone. | ---------- | H. K. Brainard, Thompsonville. | " " |
| 670 | Bone Meal. | Rafferty & Williams, New York. | S. A. Weldon & Son, Bristol. | S. R. Gridley, Oct. 6, 1881. |
| 801 | Ground Bone. | Preston & Sons, Greenpoint, L. I. | E. N. Pierce & Co., Plainville. | Station Agent. |
| 817 | Marine Bone. | Rogers & Hubbard Co. | Manufacturers. | Chas. Fairchild. |

## Dry Ground Fish.

During the year no samples of this fertilizer have been sent to the Station by purchasers or dealers. The two examinations made, were partial analyses for private parties.

## Nitrates of Potash and Soda.

**837.** Saltpeter. From stock of E. B. Botchford, New Milford.

**838.** Nitrate of Soda. From stock of Merritt Beach, New Milford.

**837** and **838** were sampled and sent by J. M. Hallock, Gaylordsville.

**811.** "Saltpeter." Sold by Martin Hungerford, Gaylordsville. Sampled and sent June 19, by G. N. Woodruff, Sherman. No printed analysis or statement of composition was attached to the barrels or accompanied the goods, which were sold under verbal guarantee that they contained 95 per cent. saltpeter.

**812.** "Saltpeter." Sold by M. L. Hungerford, Gaylord's Bridge. Sampled and sent June 20th, by A. G. Barnes, New Milford. No guarantee upon the barrel. Stated to be pure saltpeter, such as is used in the manufacture of powder.

**813.** "Saltpeter." Sampled and sent June 19th, by H. T. Haviland, Sherman.

The results of the analyses of **811, 812** and **813** were reported to Messrs. Woodruff, Barnes and Haviland, June 30th. In a few days after came to hand—

**819.** "Saltpeter." Sold by M. L. Hungerford. Sampled and sent July 3d, by Geo. G. Hungerford, Gaylordsville. "Name and address of manufacturer not known."

This last sample contained besides the rhombohedral crystals of soda-saltpeter with nearly square faces, a number of long prismatic crystals of common or potash saltpeter.

### Analyses and Valuations.

| | 837 | 838 | 811 | 812 | 813 | 819 |
|---|---|---|---|---|---|---|
| Nitrogen in nitrates | 12.98 | 14.29 | 6.24 | 5.53 | 7.12 | 10.76 |
| Potash | 44.65 | ---- | none | none | none | 13.38 |
| Magnesia | ---- | .86 | ---- | ---- | ---- | ---- |
| Chlorine | 2.06 | 2.66 | 38.11 | 39.47 | 33.70 | 17.83 |
| Water | 1.12 | 3.78 | ---- | ---- | --- | ---- |

The composition of these articles, as deduced from the above analytical determinations, may be represented as follows:

| | 837 | 838 | 811 | 812 | 813 | 819 |
|---|---|---|---|---|---|---|
| Sodium nitrate (soda-saltpeter) | ---- | 86.76 | 37.89 | 33.57 | 43.23 | 41.22 |
| Potassium nitrate (potash-saltpeter) | 93.78 | ---- | none | none | none | 28.72 |
| Sodium chloride (common salt) | 2.24 | 4.38 | 62.11 | 65.05 | 55.51 | 29.38 |
| Potassium chloride | 1.47 | ---- | ---- | ---- | ---- | ---- |
| Magnesium sulphate | ---- | 2.59 | ---- | ---- | ---- | ---- |
| Water | 1.12 | 3.78 | ---- | ---- | ---- | ---- |
| Other matters, not determined | 1.39 | 2.49 | ---- | 1.38 | 1.26 | .68 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Commercial value of nitrogen* per ton | $67.50 | 74.31 | 32.45 | 28.75 | 37.02 | 55.95 |
| " " " potash† " | $62.51 | ---- | ---- | ---- | ---- | 18.73 |
| " " " salt‡ " | ---- | ---- | $6.70 | 7.00 | 6.00 | 3.25 |
| Estimated value per ton | $130.01 | 74.31 | 39.15 | 35.75 | 43.02 | 77.93 |
| | ** | ** | †† | †† | not | †† |
| Cost per ton | $600.00 | 100.00 | 130.00 | 130.00 | stated | 130.00 |

* Reckoned from the Station price of nitrogen in nitrates, viz: 26 cents per lb.]

† Potash is valued at 7 cents per lb.

‡ Assuming agricultural salt, containing 94 per cent. sodium chloride, to cost $10.00 per ton. See Station Report for 1881, p. 53.

** Reckoned from price per cwt.

†† Reckoned from price per pound, 6½ cents.

The term "saltpeter" properly refers to nitrate of potash which in its pure state contains 53.4 per cent. of potash and 46.6 per cent. of nitric acid, the latter equivalent to (containing) 13.84 per cent. of nitrogen. **837** is the commercial article of fair quality. Refined saltpeter is now quoted at from 7 to 9 cts. per lb. and can be bought in New York for that price in 100 lb. packages. At that price saltpeter can be obtained by consumers in New Milford for from $140 to $180 per ton with the cost of freight from New York added. Nitrate of Soda, also called "cubic niter," or "Chili saltpeter" contains in the pure state 36.5 per cent. of soda and 63.5 per cent. of nitric acid, the latter equivalent to 16.46 per cent. of nitrogen. The commercial article usually contains 95 per cent. of pure nitrate of soda, from 1 to 3 per cent. of moisture, besides a little chloride of sodium (salt) and dirt. **838** is nitrate of soda of rather poor quality; containing 2.6 per cent. of Epsom salts and rather more salt and dirt than first rate goods do. 95 per cent. nitrate of soda has retailed in the New York and Philadelphia markets this year at about $76.50 per ton. In some cases as low as $67.50.

The samples sent from Sherman and New Milford, as "pure saltpeter, such as is used in the manufacture of powder," **811, 812** and **813,** are variable mixtures of soda-saltpeter (Chili saltpeter) with common salt, the latter predominating, and contain no potash at all, while as said before such saltpeter as is used in making gunpowder contains 46.6 per cent. of potash. Pure potash-saltpeter by the Station valuation for 1882 has an estimated value of $136.00 per ton. These "saltpeters" are worth commercially but $43, $39 and $35.75 respectively, and not only are destitute of potash, an essential ingredient of that saltpeter which it is claimed they were represented to be, but they contain 56 to 65 per cent. of common salt, which is not, in general, a benefit to land or crops, even when applied cautiously and in small quantity, and is often an injury, especially on tobacco, the burning quality of which it is believed to impair very seriously.

The last sample, **819,** contains a considerable proportion of potash-saltpeter, and has about double the money-worth of the others, yet nearly 30 per cent. of it is common salt and its cost exceeds its value by more than fifty dollars per ton.

### Sulphate of Ammonia.

One sample of this article has been examined the past year with the following result:

**778.** Sulphate of Ammonia from the Bradley Fertilizer Co., Boston, Mass.; sold by H. D. Torrey, Putnam; sampled and sent by W. I. Bartholomew, Putnam.

Analysis.

| | |
|---|---|
| Nitrogen, | 20.56 |
| Equivalent Sulphate of Ammonia, | 96.90 |
| Cost per 100 lbs., | $ 6.00 |
| Cost of nitrogen per 100 lbs., | $29.11 |

The quality of this article is unexceptionable. Inferior grades of "Sulphate of Ammonia" sometimes come into the market, which contain a part of their nitrogen in the form of cyanides and sulpho-cyanides of ammonium, and are therefore poisonous and destructive to vegetation.

## Dried Blood and Tankage.

Four analyses of these materials have been made for private parties, and the results are here given with the other analyses made for purchasers. **736.** Dried Blood, made by Sperry & Barnes, New Haven; sent by J. J. Webb, Hamden. **768.** Tankage, made by Strong, Barnes, Hart & Co., New Haven; sent by J. M. Hubbard, Middletown. **702, 703** and **704** are samples of comparatively pure dried blood containing very little bone. "Tankage" is a mixture of blood and offal of various sorts with fragments of bone. It contains less nitrogen, more phosphoric acid and usually more moisture than the pure dried blood. **736, 768** and **784** are all articles of this class.

Analyses.

| | 736 | 768 | 784 | 702 | 703 | 704 |
|---|---|---|---|---|---|---|
| Nitrogen, | 7.43 | 6.99 | 6.96 | 11.08 | 10.08 | 10.01 |
| Equivalent ammonia, | 9.02 | 8.49 | 8.45 | 13.45 | 12.24 | 12.15 |
| Phosphoric acid, | 7.46 | 6.90 | 4.14 | | | |
| Moisture, | | | 30.26 | 9.27 | 18.99 | 19.00 |
| Estimated value per ton, | $44.61 | 41.83 | | | | |
| Cost per ton, | $35.00 | 35.00 | | | | |

Allowing 6 cents per pound for the phosphoric acid in **736** and **768,** the nitrogen costs 18 cents in one and 19 in the other. No other fertilizers examined this year furnish nitrogen in so cheap and readily assimilable a form.

## Cotton Seed and Castor Pomace.

*Analyses and Valuations.*

**706.** Castor Pomace, manufactured by H. Mayhew & Son, Fort Scott, Kansas. Sampled and sent by E. F. Collins, Somers. Not finely ground.

**723.** I.X.L. Castor Pomace, manufactured by R. B. Brown & Co., St. Louis. Sampled and sent by A. P. Hills, East Hartford.

**746.** Jersey Castor Pomace, manufacturer not known. Sampled from stock of A. W. Allen, Jr., Thompsonville, by the Station Agent.

**748.** Cotton Seed Meal. Sampled from stock of H. K. Brainard, Thompsonville, by the Station Agent.

Analyses and Valuations.

| | 706 | 723 | 746 | 748 |
|---|---|---|---|---|
| Nitrogen, | 5.01 | 5.73 | 4.95 | 6.55 |
| Phosphoric acid, | 1.89 | 2.06 | 1.55 | 3.52 |
| Potash, | 0.94 | 1.19 | 1.08 | 2.05 |
| Cost per ton, | Not given. | $30.00 | 32.00 | 29.00 |
| Estimated value per ton, | $21.25 | 24.29 | 20.74 | 29.85 |

**723** appears to contain a large admixture of Cotton Seed Meal, to which its greater content of nitrogen is due.

Some tobacco growers believe that Castor Pomace has a particularly favorable effect on the quality of the tobacco leaf, which cannot be produced by other nitrogenous manures, and therefore prefer to pay a special price for nitrogen in this form. The Station valuations, however, as is abundantly explained elsewhere, do not and are not designed to indicate the *agricultural* value of fertilizers, but represent the average market prices of their different ingredients.

## Fowl Manure.

A sample of this material, **684**, sold by Horatio Lothrop, Suffield, and sent by H. H. Austin, Suffield, has the following composition:

| | |
|---|---|
| Nitrogen, | 3.25 |
| Insoluble in acid (sand and soil), | 38.20 |
| Potash, | 1.12 |
| Phosphoric acid, | 2.83 |
| Estimated value per ton, | $19.43 |
| Cost, | $27.00 |

The fowl manure was quite dry. It contained a considerable quantity of feathers. In it nitrogen is valued at 20 cents, phosphoric acid at 9 cents, and potash at 6 cents.

## Tripe Refuse.

**701**. Refuse from Tripe Factory, composted with earth. Sent by Newton Brothers, 341 Asylum St., Hartford.

Analysis.

| | |
|---|---|
| Nitrogen, | 2.20 |
| Phosphoric acid, | 2.91 |
| Sand and soil, | 3.49 |
| Estimated value, | $9.51 |
| Cost per ton, | not known. |

The Tripe refuse contained about 60 per cent. of moisture, and on burning left 9 per cent. of ash, of which 5.5 per cent. was soluble in dilute acid and consisted chiefly of bone-ash (phosphate of lime). The sample was accordingly nearly free from "earth." Its nitrogen is valued at 15 cents, its phosphoric acid at 5 cents. Its mechanical condition was coarse.

### Damaged Tea.

**705.** Sold by H. J. Baker & Bro., New York; sent by Edwin Hoyt, New Canaan.

Analysis.

| | |
|---|---|
| Nitrogen, | 2.04 |
| Ash, | 11.99 |
| Water, | 54.44 |

### Potash Salts.

On pages 48 and 49 are tabulated the analyses and valuations of 9 fertilizers belonging in this class. Five of them are high grade muriates, three double sulphates of potash and magnesia and one kainite.

**798** was stated to have been taken from a bag, also sent, on which, besides one word too indistinct to make out, the following was printed:

"Actual Sulphate of Potash. Patented by Dr. F. Dupre and C. H. Hake, Germany and America. Manufactured by the Stassfurter Chemische Fabrik, Stassfurt. J. H. Salmon, New York, Agent.

From the analytical results the following composition is calculated for **775** and **798**:

| | 775 | 798 |
|---|---|---|
| Sulphate of potash, | 47.82 | 45.85 |
| " magnesia, | 35.79 | 39.03 |
| Soda, chlorine, water, &c., | 16.39 | 15.12 |
| | 100.00 | 100.00 |

Sulphate of magnesia is now offered for agricultural use in "Kieserite" which contains about 80 per cent. and is quoted at \$4.50 to \$5.25 per ton wholesale. Adding to the highest of these figures 20 per cent., we have \$6.30 as a fair retail price. The samples **775** and **798** which contain 36 to 40 per cent. of sulphate of magnesia have, accordingly, about \$3.00 worth of that sub-

## Potash Salts.

| Station No. | Name. | Importer. | Dealer. | Sampled and Sent by |
|---|---|---|---|---|
| 728 | Muriate of Potash, 80–84 per cent. | H. J. Baker & Bro., New York. | Dennis Fenn, Milford. | Dennis Fenn. |
| 734 | " " 80 " | " " " " | ------------ | J. J. Webb, Hamden. |
| 769 | " " 80 " | " " " " | Wilson & Burr, Middletown. | J. M. Hubbard, Middletown. |
| 765 | " " 80 " | ------------ | S. J. Hall, Meriden. | Oliver Riee, Meriden. |
| 777 | " " | Wm. L. Bradley, Boston, Mass. | H. D. Torrey, Putnam. | W. I. Bartholomew, Putnam. |
| 823 | Sulphate of Potash. | ------------ | Geo. B. Forrester, New York. | S. B. Wakeman, Saugatuck. |
| 809 | Acorn Brand German Potash Salts. | Williams, Clark & Co., New York. | O. F. Strunz, Bristol. | Station Agent. |
| 775 | Double Sulphate of Potash and Magnesia. | ------------ | H. J. Lathrop, Suffield. | W. F. Fuller, Suffield. |
| 798 | Actual Sulphate of Potash. | ------------ | ------------ | J. H. Lathrop, Suffield. |

*Analyses.*

| | 728 | 734 | 769 | 765 | 777 | 823 | 809 | 775 | 798 |
|---|---|---|---|---|---|---|---|---|---|
| Potash (potassium oxide) | 55.25 | 50.23 | 51.21 | 52.13 | 54.14 | 24.20 | 11.63 | 25.86 | 24.80 |
| Equivalent to pure muriate | 86.81 | 79.02 | 80.56 | 82.57 | 85.70 | ---- | ---- | ---- | ---- |
| " " " sulphate | ---- | ---- | ---- | ---- | ---- | 44.82 | 21.50 | 47.82 | 45.85 |
| Magnesia | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 11.93 | 13.01 |
| Chlorine | ---- | ---- | ---- | ---- | ---- | 2.20 | 25.07 | .90 | 3.93 |
| Potash guaranteed or implied in brand | 50 | 50 | 50 | 50 | ---- | ---- | ---- | ---- | ---- |
| Muriate guaranteed | 80 | 80 | 80 | 80 | ---- | ---- | ---- | ---- | ---- |
| Sulphate guaranteed | ---- | ---- | ---- | ---- | ---- | ---- | 22 | ---- | ---- |
| Cost per ton | $50.00 | *10.00 | 42.50 | 45.00 | **60.00 | †37.57 | 15.00 | 38.00 | 35.00 |
| Estimated value per ton | ---- | ---- | ---- | ---- | ---- | 33.88 | 11.63 | ---- | ---- |
| Cost per 100 lbs. of potash | $4.53 | 3.98 | 4.15 | 4.31 | 5.54 | 7.76 | 6.44 | ‡7.34 | ‡7.05 |

* In New York. ** Reckoned from price per 100 lbs. † Reckoned from price of bbl., 346 lbs., net.
‡ Making no allowance for sulphate of magnesia.

stance per ton: allowing for it, 100 pounds of potash in **775** cost $6.77 and in **798** cost $6.45.

The analyses show that the two brands "Double Sulphate of Potash and Magnesia," and "Actual Sulphate of Potash," are practically the same thing.

In the high grade muriate, actual potash has cost at retail from 4 to 5½ cents a pound; on the average 4½ cents, or half a cent a pound less than is credited for it in the Station valuation.

## Land Plaster.

**834.** Cayuga Plaster, sent by P. M. Augur & Sons, Middlefield.

Analysis.

| | |
|---|---|
| Hydrated sulphate of lime or plaster, | 68.71 |
| Insoluble in acid | 7.50 |
| Carbonates, | 23.79 |
| | 100.00 |
| Cost per ton, | $6.00 |

The Land Plaster from New York State, Onondaga and Cayuga plaster, contains usually from 65 to 75 per cent. of hydrated plaster, 6–8 per cent. of insoluble matter, besides from 18 to 28 per cent. of carbonate of lime.

Nova Scotia plaster has on the average 94 per cent. of hydrated plaster, 2 per cent. of insoluble matter and 4 per cent. of carbonates.

## Lime.

**796.** Fertilizer Lime from Canaan, Ct. Sold by H. K. Brainard, Thompsonville. Sampled and sent by W. F. Fuller, Suffield.

**797.** Fertilizer Lime (from Pennsylvania?) Sold by W. F. Fuller, Suffield. Sampled and sent by H. H. Austin.

The direct results of the analyses were as follows:—

| | 796 | 797 |
|---|---|---|
| Lime, | 70.12 | 45.08 |
| Magnesia, | .67 | 31.59 |
| Oxide of iron and alumina, | .20 | 3.61 |
| Carbonic acid, | 7.76 | 3.48 |
| Water, | 20.50 | 4.77 |
| Silica, | | 5.56 |
| Insoluble in acid, | .28 | 5.78 |
| Undetermined matters and loss, | .47 | .13 |
| | 100.00 | 100.00 |
| Cost per ton, | $9.00 | $8.00 |

The compounds actually existing in the Canaan lime, **796**, are almost certainly, both in kind and quantity, as given below. The state of combination of the ingredients of **797** cannot be so positively ascertained from the analysis. The statement below is probably correct except that the silica is combined with the iron and a small part of the lime (perhaps also with a little magnesia and alumina). The quantities of lime, etc., that thus chemically unite to silica in the burning of impure limestones, such as yield **797**, depend upon the temperature to which the rock is subjected in the kiln.

| | 796 | 797 |
|---|---|---|
| Calcium hydrate (slacked lime), | 79.61 | 12.62 |
| Calcium carbonate (carbonate of lime). | 17.63 | 7.91 |
| Magnesium hydrate, | .98 | |
| Magnesium oxide (magnesia). | | 31.59 |
| Calcium oxide (lime). | | 32.80 |
| Oxide of iron and alumina, | .20 | 3.61 |
| Matters insoluble in acid, | .28 | 5.78 |
| Silica (combined with lime and iron as silicates,) | | 5.56 |
| Moisture, undetermined matters and loss. | 1.30 | .13 |
| | 100.00 | 100.00 |

The effect of much silicates (glass- or slag-like compounds formed by strongly heating together silica and lime or iron) in a lime is to "bind" the lime and retard slacking. The effect of magnesia, especially in large proportion, is also to retard or prevent slacking and to diminish the caustic or corroding quality of the lime.

Sample **797** is stated not to have heated when drenched with water, but after standing three weeks it crumbled without killing the grass on which it was heaped.

The question of the comparative value of the two samples is an important one. **797** was bought for application upon tobacco-land. The value of lime applied to land is of two sorts. It may be of service by its caustic or alkaline character in virtue of which it, for example, provokes decomposition of the inert nitrogen-compounds of the soil and thus acts indirectly as a supply of nitrogen. For this use **796** is much superior to **797**. The other mode of action of fertilizer-lime lies in its direct supply of plant-food. On a soil destitute of magnesia, **797** would be better than **796**, but magnesia is commonly abundant enough in our soils, and while an occasional application of a magnesia fertilizer may be advantageous we may conclude that, generally speaking, a nearly pure lime is preferable to one containing a large proportion of magnesia.

## Limestone.

**709.** Limestone, quarried about forty years ago.
**710.** Limestone, from top of layer.
Both samples were sent by L. Elliot, Durham.

Analyses.

| | 709 | 710 |
|---|---|---|
| Insoluble in acid (sand and soil), | 1.84 | 3.71 |
| Lime, | 53.91 | 52.91 |
| Magnesia, | .63 | .52 |
| Phosphoric acid, | .08 | .12 |
| Carbonic acid, etc., by difference, | 43.54 | 42.74 |
| | 100.00 | 100.00 |

The composition may also be stated as follows:—

| | 709 | 710 |
|---|---|---|
| Carbonate of lime, | 96.14 | 94.30 |
| Carbonate of magnesia, | 1.32 | 1.09 |
| Phosphate of lime, | .15 | .22 |
| Silica, etc., insoluble in dilute nitric acid, | 1.84 | 3.71 |
| Undetermined matters (carbonate of iron ?) and loss. | .55 | .68 |
| | 100.00 | 100.00 |

These limestones are comparatively pure carbonate of lime.

## Shell Marl.

**698.** Shell marl sent by Prof. J. Hoyes Panton, Guelph, Canada.

Analysis.

| | |
|---|---|
| Moisture, | .24 |
| Insoluble in acid, | .41 |
| Oxide of iron, | .29 |
| Lime, | 53.03 |
| Magnesia and other matters, | 1.07 |
| Carbonic acid and combined water, | 44.96 |
| Phosphoric acid, | trace |
| | 100.00 |

## Norfolk Fertilizer.

**772.** Norfolk Fertilizer. Made by Styron, Whitehurst & Co., Norfolk, Va. Sampled, sent, and sold by M. B. W. Wheeler, Westport.

The direct results of analysis were as follows:

| | |
|---|---|
| Lime, | 43.43 |
| Magnesia, | 1.39 |
| Soda, | 5.44 |
| Potash, | .93 |
| Oxide of iron, | .51 |
| Chlorine, | 6.55 |
| Phosphoric acid, | .16 |
| Sulphuric acid, | 1.78 |
| Carbonic acid, | 11.23 |
| Insoluble matters, | 2.67 |
| Moisture at 212°, | 16.01 |
| Combined water, by difference, | 9.90 |
| | 100.00 |

The actual state of combination of the ingredients of the "Norfolk fertilizer" is probably the following:—

| | |
|---|---|
| Common salt (sodium chloride), | 10.26 |
| Muriate of potash (potassium chloride), | .67 |
| Sulphate of potash (potassium sulphate), | .95 |
| Gypsum (hydrated calcium sulphate) | 2.88 |
| Carbonate of lime (calcium carbonate), | 25.52 |
| Slacked lime (calcium hydrate), | 37.26 |
| Slacked magnesia (magnesium hydrate), | 2.02 |
| Phosphate of iron, | .67 |
| Sand and insoluble matters, | 2.67 |
| Moisture and loss, | 17.10 |
| | 100.00 |

The Norfolk Fertilizer is a mixture of ground oyster-shells and slacked lime with some 15 per cent. of "kainite" or similar low-grade "potash-salts" or the equivalent. Its fertilizing and commercial values are about those of leached ashes. The Connecticut farmer can scarcely afford to pay more than $7 to $8 per ton for it. The price quoted to the Station was $30.

## Fossil Marl.

**786.** Fossil Marl. Sampled and sent by Jones Brothers, South Windsor. R. W. Roberts, East Hartford, dealer.

"Fossil Marl" in this instance is the Green Sand Marl of New Jersey. The sample **786** is quite similar to **316** analyzed at this Station in 1879 (see Station Report for that year, p. 46). Below are given the full analysis of **316** and a partial analysis of **786.**

| | 316 | 786 |
|---|---|---|
| Moisture, | 16.70 | 17.64 |
| Combined water, | 3.26 | |
| Sand, insoluble silica, | 18.33 | |
| Soluble silica, | 26.65 | |
| Oxides of iron and alumina, | 23.00 | |
| Lime, | .43 | |
| Magnesia, | 3.12 | |
| Potash, | 5.69 | |
| Soda, | .60 | |
| Phosphoric acid, | .90 | .92 |
| Undetermined matters, | .42 | |
| | 100.00 | |
| Cost per ton, | | $10.00 |

The analysis given in the pamphlet (issued by Hooper & Co., General Agents) accompanying the sample gives phosphoric acid at 2.8 per cent. and potash at 7.3 per cent. The sample contains but one-third that amount of the former, and as to the latter it exists as a silicate—in the mineral *glauconite*, which gives the green color to the marl—and is insoluble or very slowly soluble, and accordingly the marl has little effect as an active fertilizer when used in small doses, but rather belongs to the class of amendments which often produce striking results on poor soils, when applied in large quantities.

This marl has been extremely useful in New Jersey on lands near to market, and but a little way removed from the marl pits, where its cost is but $3 to $5 per ton. To transport it to Connecticut can hardly be profitable to the farmer here, unless all the circumstances are favorable to laying it on at low cost.

## Marine Mud.

**685.** The sample was sent by Wm. T. Foote, Esq., of Guilford.

### Analysis.

| | |
|---|---|
| Water, | 45.68 |
| Organic and volatile, | 4.54* |
| Insoluble in acid (sand and soil), | 40.97 |
| Oxide of iron and alumina, | 6.14 |
| Lime, | .90 |
| Magnesia, | .05 |
| Potash, | .36 |
| Soda, | .56 |
| Sulphuric acid, | .79 |
| Phosphoric acid, | trace |
| | 100.00 |

* Containing nitrogen 0.18

This Marine Mud, compared with stable manure is as rich or richer in lime, magnesia, potash, soda and sulphuric acid. It contains but one-third as much nitrogen and is quite deficient in phosphoric acid. It would serve admirably to use in connection with fish manures, which supply little besides nitrogen and phosphates.

Mr. Foote writes as follows regarding this mud :—

"The mud is washed into a small bay between Sachem's Head and Mulberry Point; and is flooded at every tide. I have had fifteen years' experience with it on light-textured though dark-colored loam with a clayish subsoil or underlaid by rock. It should be dug in winter; the action of the frost pulverizes it till it is like ashes. It is then left to dry a month or so. If dug in summer it bakes hard. I cart it to fields from twenty rods to half a mile distant. It costs two cents a bushel dumped on the field ready to spread. I use from 800 to 1000 bushels per acre, in drills and in hills, broadcast on pasture or spread and plowed in. When I used 2000 bush. mud to the acre I raised potatoes at the rate of 400 bush. One cart load was accidentally spread upon a space about 15 feet square and plowed in, and a very large crop was the result; from one hill I took 13 potatoes (all there were) which weighed 6½ lbs. With corn I tried alternate rows of mud and yard-manure; the latter from a yard of twenty cows where 1100 bush. of grain had been fed in the winter. Early in the season the mud rows did not show as well as the other; later they caught up and were equal in results to the other, in size of stalk and amount of grain.

In good corn years I have had 100 bush. of shelled corn to the acre with mud alone; but the general average is 75 bush. This last year of late drouth, the best corn was on the driest land with mud. With wheat this year I used barn-yard, hog-pen, and mud manure with an average crop of 25 bush. per acre to all three. With rye I do not find it successful, though others do who have used it on sandier soil. Of English hay I have 3 tons per acre where nothing but mud has been used for years.

Top-dressing pastures once in three years keeps them in fine grass and apparently would do so forever. I do not find it quick enough for an early vegetable garden, without some other more heating manure. With beets I have raised 900 to 1000 bush. per acre."

## Review of the Fertilizer Market.

*Organic Nitrogen* in Dried Blood, Azotin and Ammonite was quoted in New York at wholesale in November, 1881, at $23.40 to $24.30 per 100 lbs., which are the maximum figures for the year. It fell a little gradually till January, 1882, and from then on quite rapidly till early summer, when nitrogen in blood sold at $19.90, and in azotin and ammonite at $19.50. Since then prices have advanced but very little, and on Nov. 1, 1882, nitrogen in blood was quoted at $19.73, and in azotin and ammonite at $19.73 to $20.49.

Thirteen analyses of blood, ammonite, fish, cotton seed, castor pomace, etc., made at the New Jersey and Connecticut Stations this year, show that the average retail cost of nitrogen in them has been $21.60 per 100 lbs. The highest price paid was $29.35, the lowest $16.80. In most cases these were *manufacturers'* retail prices, and do not include freight and the charges of middle-men.

Two samples of Castor Pomace from the stock of *retail agents* in this State furnished nitrogen at $23 and $29.35 (allowing 6 cts. and 5 cts. respectively for the phosphoric acid and potash in them), though in the cheaper article there was evidently a large admixture of cotton seed.

The single sample of cotton seed meal analyzed, with the allowance mentioned above for phosphoric acid and potash, furnished nitrogen at $17.35 per 100 lbs.

There is no other ingredient in commercial fertilizers which shows such wide differences in retail cost as organic nitrogen, and none which requires as much judgment in its purchase, if the buyer desires to get it at the best advantage to himself.

*Nitrogen in Ammonia Salts*, on the first of November, 1881, cost $25.60 per 100 lbs. *at wholesale*, and remained stationary in price till March, 1882. Since then it has fallen, and from June on has been quoted at $22.40 per 100 lbs. The average *retail* price of nitrogen in this form in New York and Philadelphia, as shown by analyses made at the New Jersey Agricultural Experiment Station and published in July, has been $23.35. The single sample examined here from a Connecticut retail dealer furnished nitrogen at $29.11. The difference between this and the retail New York prices is caused in part by cost of handling and transportation.

*Nitrogen in Nitrate of Soda* has cost *at wholesale* through the year less than in any other form. It was quoted in November, 1881, at $20.40 per 100 lbs., which is the highest figure for the year. From then it steadily declined till last September, when it cost $16.80, and on the first of November of this year stood at $17.55 to $18.40. The average price asked by the large retail houses in New York has been about $22 to $23, according to the bulletin of the New Jersey Station. No analyses have been made in this Station of articles of this class which were of average quality or price.

*Soluble Phosphoric Acid* in the three samples examined here has cost at retail in this State $10.84 on the average. In New York it has retailed at $10.72 when made from South Carolina rock, and a little less when made from bone black.

*Insoluble Phosphoric Acid* has shown no very marked changes during the year. Charleston rock unground, "free on board," (f. o. b.) at Charleston was quoted at $8.80 per ton in January, and has fallen since, the quotation on Nov. 1st, 1882, being $6 to $6.50. Ground and rough bone have also been quite steady in price, the latter sort ruling highest in November and December, 1881.

*Potash as high grade* (80 *per cent.*) *muriate* has been very steady, prices ranging from $3.24 to $4.06 per 100 lbs., since May, 1881, and averaging $3.60; small lots purchased in New York have cost on the average $4. In Connecticut it has retailed this year for about $4.50.

*Potash as high grade sulphate* seems not to be in the retail market in Connecticut to any amount.

*Potash in the double sulphate of potash and magnesia* has cost, making liberal valuation for sulphate of magnesia, $6.77 and $6.45 per 100 lbs. at retail in the Connecticut market. Only one sample of kainite has been analyzed here. Potash in that article has retailed in New Jersey for $5.06 per 100 lbs. on the average.

From the Review of the Fertilizer Market it appears that the prices of certain fertilizers have varied very considerably during the year. To take a single instance: the nitrogen of dried blood cost at wholesale not far from 23½ cents a pound in November, 1881, but could be got for a little less than 19 cents a pound 7 months later, in June, 1882. Assuming that the blood had 10 per cent. of nitrogen, this would be a difference of over $7 per ton in the cost, an item well worth saving if it can be saved.

Individual purchasers, buying small lots, cannot probably secure any considerable advantage by watching the state of the market, but farmers' clubs and other associations of farmers may find that it pays them well to carefully watch the market and to buy their fertilizers in one lot and at a time when wholesale prices rule low.

The following explanations will be helpful in the examination of market quotations.

*Phosphate rock*, *kainite*, *bone*, *fish scrap*, *tankage*, and some other articles are quoted and sold by the ton. The seller usually has an analysis of his stock, and purchasers often control this by an analysis at the time of purchase.

*Sulphate of ammonia*, *nitrate of soda and muriate of potash* are quoted and sold by the pound and generally their wholesale and retail rates do not differ very widely.

*Blood*, *azotin and ammonite* are quoted at so much "per unit of ammonia." A "unit of ammonia" is one per cent. or 20 lbs. per ton. To illustrate, if a lot of dried blood has 7.0 per cent. of nitrogen, equivalent to 8.5 per cent. of ammonia, it is said to contain $8\frac{1}{2}$ units of ammonia, and if it is quoted at $3.75 per unit, a ton of it will cost $8\frac{1}{2} \times 3.75 = \$31.88$.

The term "ammonia" is *properly* used only in those cases where the nitrogen actually exists in the form of ammonia, but it is a usage of the trade to reckon all nitrogen, in whatever form it occurs, as ammonia.

To facilitate finding the actual cost of nitrogen per pound from the cost per unit of ammonia in the market reports, the following table is given.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ammonia at | $4.00 | per unit | is equivalent to | nitrogen at | 24.3 | cts. | per lb. |
| " | 3.90 | " | " | " | 23.7 | " | " |
| " | 3.80 | " | " | " | 23.0 | " | " |
| " | 3.70 | " | " | " | 22.4 | " | " |
| " | 3.60 | " | " | " | 21.8 | " | " |
| " | 3.50 | " | " | " | 21.2 | " | " |
| " | 3.40 | " | " | " | 20.6 | " | " |
| " | 3.30 | " | " | " | 20.0 | " | " |
| " | 3.20 | " | " | " | 19.4 | " | " |
| " | 3.10 | " | " | " | 18.8 | " | " |
| " | 3.00 | " | " | " | 18.2 | " | " |

Commercial sulphate of ammonia contains on the average 20 per cent. of nitrogen, though it is found to vary considerably in quality. When it has that amount of nitrogen (equivalent to 24.3 per cent. of ammonia),

| | | | | | |
|---|---|---|---|---|---|
| At $5\frac{1}{2}$ | cents per lb. | Nitrogen | costs | 27.5 | cents per lb. |
| " $5\frac{3}{8}$ | " | " | " | 26.8 | " |
| " $5\frac{1}{4}$ | " | " | " | 26.3 | " |
| " $5\frac{1}{8}$ | " | " | " | 25.6 | " |
| " 5 | " | " | " | 25.0 | " |
| " $4\frac{7}{8}$ | " | " | " | 24.4 | " |
| " $4\frac{6}{8}$ | " | " | " | 23.8 | " |
| " $4\frac{5}{8}$ | " | " | " | 23.1 | " |
| " $4\frac{1}{2}$ | " | " | " | 22.5 | " |

Commercial nitrate of soda averages 95 per cent. of the pure salt or 15.6 per cent. of nitrogen.

| | | | | | | |
|---|---|---|---|---|---|---|
| If quoted at | $3\frac{5}{8}$ | cents per lb. | Nitrogen | costs | 23.2 | cents per lb. |
| " | $3\frac{1}{2}$ | " | " | " | 22.3 | " |
| " | $3\frac{3}{8}$ | " | " | " | 21.5 | " |
| " | $3\frac{1}{4}$ | " | " | " | 20.8 | " |
| " | $3\frac{1}{8}$ | " | " | " | 19.9 | " |
| " | 3 | " | " | " | 19.2 | " |
| " | $2\frac{7}{8}$ | " | " | " | 18.3 | " |
| " | $2\frac{3}{4}$ | " | " | " | 17.6 | " |
| " | $2\frac{5}{8}$ | " | " | " | 16.9 | " |
| " | $2\frac{1}{2}$ | " | " | " | 16.0 | " |

Commercial muriate of potash usually has 80 per cent. of the pure salt, or $50\frac{1}{2}$ per cent. of actual potash.

| | | | | | | |
|---|---|---|---|---|---|---|
| If quoted at | 2.25 | cts. per lb. | Actual potash | costs | 4.46 | cts. per lb. |
| " | 2.20 | " | " | " | 4.36 | " |
| " | 2.15 | " | " | " | 4.26 | " |
| " | 2.10 | " | " | " | 4.16 | " |
| " | 2.05 | " | " | " | 4.06 | " |
| " | 2.00 | " | " | " | 3.96 | " |
| " | 1.95 | " | " | " | 3.86 | " |
| " | 1.90 | " | " | " | 3.76 | " |
| " | 1.85 | " | " | " | 3.66 | " |
| " | 1.80 | " | " | " | 3.56 | " |
| " | 1.75 | " | " | " | 3.46 | " |
| " | 1.70 | " | " | " | 3.36 | " |
| " | 1.65 | " | " | " | 3.26 | " |
| " | 1.60 | " | " | " | 3.16 | " |

The accompanying table, prepared by Mr. Hutchinson, shows the fluctuations in the wholesale prices of a number of fertilizing materials in the New York market, during the last 19 months. The price given for each month is the average of the four weekly quotations in that month. Sulphate of ammonia is assumed to contain 20 per cent. and nitrate of soda 15.6 per cent. of nitrogen, and muriate of potash $50\frac{1}{2}$ per cent. of actual potash or 80 per cent. of the pure salt. For three months azotin and ammonite were not quoted at all.

| | | Cost of Nitrogen at Wholesale in | | | | Cost of Potash at Wholesale in |
|---|---|---|---|---|---|---|
| | | Blood. cts. per lb. | Azotin and Ammonite. cts. per lb. | Nitrate of Soda. cts. per lb. | Sulphate of Ammonia. cts. per lb. | Muriate of Potash. cts. per lb. |
| 1881. | May | 21.3 | 21.8 | 21.9 | 24.7 | 3.78 |
| | June | 21.5 | 21.8 | 21.1 | 24.8 | 3.86 |
| | July | 22.0 | 21.8 | 20.8 | 25.6 | 3.92 |
| | August | 22.4 | 22.1 | 20.8 | 25.2 | 4.06 |
| | September | 23.8 | .... | 20.9 | 24.7 | 3.78 |
| | October | 23.0 | 24.3 | 20.8 | 24.9 | 3.64 |
| | November | 23.3 | 24.3 | 20.4 | 25.6 | 3.62 |
| | December | 23.1 | .... | 20.3 | 25.7 | 3.60 |
| 1882. | January | 23.0 | .... | 19.9 | 25.6 | 3.71 |
| | February | 22.3 | 22.2 | 19.8 | 25.6 | 3.60 |
| | March | 19.6 | 20.1 | 18.3 | 25.0 | 3.36 |
| | April | 19.7 | 19.7 | 18.4 | 23.8 | 3.24 |
| | May | 19.1 | 19.7 | 18.3 | 22.7 | 3.26 |
| | June | 18.9 | 19.7 | 16.9 | 22.4 | 3.28 |
| | July | 19.8 | 19.5 | 16.8 | 22.4 | 3.40 |
| | August | 19.5 | 19.5 | 16.8 | 22.4 | 3.52 |
| | September | 19.7 | 20.3 | 17.7 | 22.4 | 3.60 |
| | October | 19.7 | 20.1 | 17.8 | 22.3 | 3.56 |
| | November | 19.7 | 20.1 | 17.5 | 22.2 | 3.56 |

## Home-made Superphosphate.

Occasional inquiries are made at the Station with regard to the method of preparing superphosphate of lime on the farm, and as to the economy of its home manufacture. It is perfectly practicable for a farmer to make a high grade and moderately fine article without any considerable outlay for apparatus. The *economy* of the manufacture depends on the prices which he has to pay for the phosphatic raw material and oil of vitriol delivered on his premises. In general it is probably cheaper for him to buy his superphosphate ready made; but it occasionally happens that he can find in his neighborhood small quantities of suitable material offered at a low rate, being a waste product from some manufacturing establishment, which of itself is comparatively inert as a fertilizer, but which can be economically treated with oil of vitriol on the farm and so be made valuable.

An instance of this kind has come to the notice of the Station within the last year. A gentleman living near a factory where iron was extensively worked found that each year a ton or two of bone char was thrown away which he could get for about $8 per ton. Bone char contains no nitrogen, but a high percentage of phosphate of lime in an inert condition. Applied directly to land little or no immediate effect was to be expected.

It was suggested that he try the experiment of treating this char with oil of vitriol, which he could buy for 1½ cts. per lb. by the carboy. The process employed was as follows: A vat was constructed by laying boards closely together on level ground, and putting up sides eight or ten inches high, after the style of a mortar bed. 500 lbs. of bone char were put in the vat, and spread somewhat, with a slight depression in the middle of the pile where the water and acid were afterwards poured. 15 gallons of water were measured into a barrel and 300 lbs. of the acid were weighed off into a crockery vessel. It could have been weighed into wood but would have charred it somewhat.—The greatest care is necessary in pouring the acid from the carboy. The receiving vessel should be held close to the neck of the carboy to prevent spattering as much as possible, and the eyes kept averted; for the acid destroys the clothing and burns the skin very quickly when it falls on it. A drop on the skin should be immediately wiped off with a cloth and the place well washed.—The water was then poured rather slowly over the bone char and mixed with a hoe till the

whole mass was wet. As soon as this was done, the acid was poured on in the same way. The mass became at once very hot, the carbonate of lime, which is always present, was decomposed, and the escape of steam and carbonic acid was attended with much frothing. This must be provided for by making the vat of sufficient size. The materials were worked over and thoroughly mixed with the hoe until the steaming and frothing had about ceased. The mixture then had the consistence of mortar, but within twenty-four hours dried to a crumbly state, and could be pulverized for spreading on the land. In this instance it was mixed with dried blood, which was bought for $35 a ton, and furnished nitrogen at 19 cents a pound. At the end of twenty-four hours samples from different batches of the phosphate were analyzed at the Station. The lowest percentage of soluble phosphoric acid found was 11 per cent., the highest 14.2 per cent., and the average 12.9 per cent. It is believed that the solvent action of the oil of vitriol was not then complete, and that tests made later would have shown a larger percentage of soluble phosphoric acid. The cost of the process was as follows:

| | |
|---|---|
| 2,000 lbs. bone char | $8.00 |
| 1,200 lbs. oil of vitriol, | 18.00 |
| Labor | 4.00 |
| | $30.00 |

Unfortunately no weighing was made of the superphosphate. Of course it could not have been less than 3,200 lbs., the weight of acid and bone, and must have been considerably more, since the sulphate of lime that is formed retains a large quantity of water. But calling its weight 3,200 lbs. and its content of soluble phosphoric acid the lowest found, 11 per cent., we have as a result 352 pounds of soluble phosphoric acid, costing $30, equivalent to $8.52 per 100 lbs., or over $2 per hundred less than the average cost in the retail market during the last year.

## Peat or Swamp Muck.

**714.** Peat from East Haven Peat Swamp, sent by Henry E. Pardee, New Haven. Surface sample containing roots.

**715.** Peat from East Haven Peat Swamp, sent by Henry E. Pardee. Sample from beneath **714,** free from roots.

**745.** Muck sent by Philip T. Vibert, Meriden, Ct.

ANALYSES.

| | 714 | 715 | 745 |
|---|---|---|---|
| The fresh material contains:— | | | |
| Water, | 70.51 | 79.66 | 80.16 |
| Organic and volatile matters. | 24.80 | 17.85 | 16.95 |
| Ash, | 4.69 | 2.49 | 2.89 |
| | 100.00 | 100.00 | 100.00 |
| The organic and volatile matters contain:— | | | |
| Nitrogen, | 1.08 | 0.66 | 0.59 |
| The ash contains:— | | | |
| Silica and insoluble, | 1.67 | .42 | .51 |
| Oxide of Iron, Alumina and Phosphoric acid, | .63 | .19 | .27 |
| Lime, | 1.37 | .74 | 1.14 |
| Undetermined, | 1.02 | 1.14 | .97 |
| | 4.69 | 2.49 | 2.89 |
| The dry mucks contain:— | | | |
| Organic and volatile matters. | 84.09 | 87.75 | 85.43 |
| Nitrogen, | 3.66 | 3.24 | 2.97 |
| Silica and insoluble, | 5.66 | 2.07 | 2.55 |
| Oxide of Iron, Alumina, &c., | 2.14 | .93 | 1.36 |
| Lime, | 4.64 | 3.64 | 5.75 |

The question of bringing a peat or muck swamp into cultivation, is one that frequently arises. The first essential of course, is drainage sufficient to remove the surface water for a depth of several feet. In small swamps the muck is commonly mixed with enough washed-in soil to admit of cultivation directly. Where the area of the bog is considerable this is commonly not the case. Peat so nearly pure as the samples here reported, contains scarcely enough mineral matters to make a good soil if merely drained. Addition of soil, sand or coal ashes would be needful to amend the texture and prevent the peat from cohering together to a crust and shrinking during dry weather in a degree injurious or fatal to crops, unless indeed frequent shallow tillage were resorted to for the prevention of such disaster. As regards plant-food, there is an ample store of the element most costly, to supply artificially, viz.: nitrogen. The fresh material of these samples contains, on the average, as much of this element as stable or yard manure (0.77 per cent.), and this will become available under suitable cultivation. Lime is also abundant. The analysis is not carried out sufficiently to show how the other mineral elements stand, and probably phosphates and potash salts would be shortly needed. With their help these peats would probably make very productive soils for many years to come.

## The Composition of Trap Rock.

"New Britain, Ct., June 13, 1882.

"I enclose a sample of the stones and pulverized matter with which our soil abounds. I desire to know if it contains potash or phosphate of lime. I presume you can tell at a glance, but if an analysis is necessary I hope you will make it. This trap rock abounds in all this region. I had an impression that such rotten stone as I send you is rich in all the mineral elements of plant food. John B. Smith."

It has not been possible hitherto to make an analysis of the sample of decayed trap rock sent by Mr. Smith, and the following answer to his inquiries was based on the general result of such investigations on the subject as have come to the writer's knowledge. By Trap Rock is meant the "blue stone" which forms the material of East and West Rocks at New Haven, of the Hanging Hills of Meriden, and of many similar elevations along the valleys of the Connecticut and Quinnipiac Rivers.

*Answer.*

The "trap rocks" of this State, so far as they have been analyzed, contain—

| | | | | |
|---|---|---|---|---|
| $7\frac{1}{2}$ | to | $10\frac{1}{2}$ | per cent. of | lime, |
| 5 | to | $7\frac{1}{2}$ | " | magnesia, |
| $2\frac{1}{2}$ | to | $3\frac{1}{2}$ | " | soda, |
| $\frac{4}{10}$ | to | $\frac{7}{10}$ | " | potash, |
| trace | to | $\frac{14}{100}$ | " | phos. acid. |

The rest of the rock consists of silica, alumina, and oxide of iron. The trap rocks are commonly very slow to disintegrate, some that contain much iron decay more rapidly. During the slow decay, the lime, magnesia and alkalies become soluble in water and wash away, so that the decayed rock is less rich in these substances than the original. The rock is a source of these forms of plant food during its decay, more than afterwards. Still the fine clayey matters that result retain small quantities of plant food, such as you will find stated in the various soil-analyses that have been published in the Station Reports. Phosphoric acid remains mostly in the residue of the decay, and potash is washed out much less relatively than soda and lime. The abundance and vigor of the vegetation on such decayed rock, provided sunlight

and moisture are suitably supplied, is a better test of the richness of the material in plant food than analysis can be, for the latter cannot always discriminate between the unaltered rock whose elements are insoluble and inaccessible to the plant, and the available plant food in the soil.

## Soils.

In December, 1881, two samples of soil were sent to the Station for analysis. The analyses were made in due time, and the results are here given with appropriate extracts from the correspondence.

**721.** Soil received from Thos. E. Porter, Coventry.

**722.** Soil sent by A. E. S. Bush, Niantic.

### Analyses.

| | 721 | 722 |
|---|---|---|
| Moisture | 2.354 | .473 |
| Organic and volatile matters * | 10.476 | 6.577 |
| Potash | .056 | .047 |
| Soda, | .074 | .093 |
| Lime, | .130 | .080 |
| Magnesia, | .130 | .186 |
| Oxide of iron and alumina, | 3.575 | 4.542 |
| Sulphuric acid, | .059 | .041 |
| Phosphoric acid, | .038 | .051 |
| Sand, silica and insoluble silicates, | 83.108 | 87.910 |
| | 100.000 | 100.000 |
| * Containing nitrogen, | .334 | .140 |

Mr. Porter wrote in substance regarding **721** :—

"The soil was taken from different parts of a twenty-five acre meadow. The meadow is surrounded on three sides by hills over which brooks and springs descend and overflow it in part during the wet season. There are no visible springs in the meadow.

"It is ditched on each side by ditches 4 feet wide and 15 to 18 inches deep. The black, wet dirt or soil is 12 inches in depth; then, in places, one or two inches of sand and below this is a thin stratum of bluish clay in some parts and below this again a coarse gravel bed. One family have lived there since 1720 and know that the sod has never until now been broken or plowed. The land is for the most part dry enough for tillage, being upland, so-called. It bears what is called June grass. When the frost comes the June grass stubble curls downward and becomes

gray. Cattle will not eat it, and it used to be hard to cut it with scythes. This field is ditched once across which carries the brook mainly by it; it was plowed in the autumn of 1881 for the first time, for the purpose of rotting out the June grass stubble which I want to exterminate and eventually put in Red Top or Fowl Meadow Grass. Wood ashes and barn-yard manure are excellent to bring fertility, but they are scarce. I would like to ascertain what ails this land. It appears to be deficient in plant-food; now what is a restorative? I will also state that this meadow turf peeled up like so many sheepskins, when plowed. I have used bone and muriate of potash, the latter with great success for potatoes."

In reply to Mr. Porter was written as follows:—

"Accompanying this you will find results of the analysis of the sample of soil received from you. All the elements of plant-food are present, and not one of them is deficient in *quantity*. Nitrogen, potash and magnesia are present in as large percentage as in some of the best wheat soils of Illinois. Unfortunately the analysis of a soil gives little information respecting the *state of availability* of the substances found, and experience shows that of the substances present which are indispensable to plant-growth, the one most abundant may be least available! This analysis does not indicate any one ingredient to whose abundance or deficiency the low fertility of the soil is due, and gives, so far as I can see, no clue to a course of treatment for improving it. It leaves us, in fact, in the same state of uncertainty as we were before the analysis was made."

With regard to sample **722** Mr. Bush wrote:—

"I forward to the Station, by express, a sample of our soil. I say 'our' because we, of this neighborhood, have considerable soil of about the same quality apparently, and an analysis of one sample may benefit a good many persons. The sample is taken as fairly as possible from different parts of a plot of about four acres. I have no doubt you will say any fertilizer would be good for it, but, if possible, I would like to know what fruits and vegetables it is best adapted to and what fertilizer is best adapted to make them grow."

To the inquiries of Mr. Bush, answer was made in similar terms as follows:—

"I give herewith the results of the analysis of your soil. I can not find in these figures any satisfactory explanation of its pov-

erty. Everything required by crops is there. Some very productive western soils are no richer in potash. The difficulty with our analyses is that we have no satisfactory means of learning the availability of the substances present. I send you herewith an analysis of a marine mud from Guilford, (No. **685**). (See p. 54). You will observe that it contains no more nitrogen* than your soil, and no weighable amount of phosphoric acid. Its lime, potash, and sulphuric acid are, indeed, 8 to 10 times more abundant than in your soil, but that does not account for the fact that a dressing of 800–1000 bushels of the mud on an acre of Guilford soil renders the latter highly productive. We must infer from the effects of the mud that its elements are in an active, quickly-available form, but the analysis does not reach that point of inquiry, and we are not much wiser in respect to what *special application* may benefit your land or adapt it to fruits, than before the analysis was made."

The application of Mr. Porter for an analysis of his soil was replied to in the following terms: "I regard it as very doubtful if the analysis will be of much service for the desired purpose, having rarely been able to draw very definite conclusions from the analysis of a soil as to what fertilizers were adapted to make it productive."

To this Mr. Porter answered: "I think that if the soil is analyzed we can between us judge what it contains and what it wants—of course there is no certainty—but I have faith that in due time science will discover exactly what any soil is deficient in and what tonic will in any case, promote fertility. The New England farmer, of the present and future, to be successful, must turn to the scientific men for help. The soil is sick and it must be built up the same as animals when sick."

It occasions much regret to be compelled to feel that, for the present, science cannot guarantee to get adequate return for work spent in soil-analysis. Undoubtedly it would be possible to learn more from analyses of the soils here under consideration, than has been learned. No doubt, it would be possible to make much more accurate and refined analyses than those here printed. Doubtless some nearer approach to a knowledge of the availability of the elements might be attained. The Station, probably, has not done as well as might be done in this branch of its work.

* Two analyses of either would usually differ more as regards nitrogen than the results on 685 and 722.

It has, however, done the best it could, under the circumstances, with due regard to its obligations in other directions.

The following extract from the Report of the Conn. Board of Agriculture for 1881, pp. 87, 88, will perhaps throw some light on this subject:—

"QUESTION. To what expense is a farmer to be if he wishes to send samples of earth to the Experiment Station for chemical analysis?

ANSWER. It will cost nothing but the freight. The answer to that question suggests another.—"What is the use of analyzing a sample of earth?" We had the idea extensively promulgated some twenty or thirty years ago, that if a sample of soil were analyzed by a competent chemist, the competent chemist could tell exactly what to put upon the field to make anything grow. Well, the competent chemist can generally tell what to put upon the field without making an analysis. Plenty of good manure will help in almost any case!

A little calculation will readily show what a chemist *cannot* do. You know that it has been frequently a matter of experience that a hundred pounds of Peruvian guano, of the old-fashioned sort that we had twenty years ago, would make the difference between a good crop and a poor crop, when it happened to be applied to the right land, with the right crop and right weather. That hundred pounds of Peruvian guano contained about fifteen per cent. of nitrogen, about fifteen per cent. of phosphoric acid, and about three per cent. of potash, to which 33 pounds of ingredients its fertilizing value was alone due. The soil of an acre of land, taken to the depth of one foot, will weigh about four millions of pounds. Thirty-three pounds of fertilizer, and four millions of pounds of soil, assuming that the crop got all its nutriment from the first foot of ground, are the two quantities which, put one above the other, the smallest at the top and a line between, make the fraction which the chemist must figure down to if he will find out from an analysis of the soil what element of fertility that soil is deficient in, viz: $\frac{33}{4,000,000}$ or $\frac{1}{121,000}$. But, in fact, if the chemist in two analyses of the same sample of soil gets results which agree within $\frac{1}{10,000}$ he is lucky and his luck does more towards that result than his skill, for usually the tenth of one per cent. or $\frac{1}{1000}$ is about the limit of accuracy in chemical analysis. It may thus easily happen that the chemist cannot by analysis distinguish between two soils, one of which has had a dressing

of 1000 lbs. of the best Peruvian guano to the acre, and the other nothing."

Mr. Porter's observation that muriate of potash was used on his land with great success for potatoes, goes to show that potash (soluble in cold hydrochloric acid) while existing in his soil to the extent of 0.056 per cent., or a long ton, (2240 lbs.) per acre, for 1 foot of depth, is not present there in such a state of solubility as that crops can gather it rapidly enough for their necessities.

The fact that a few hundred pounds of active (soluble) fertilizers give good crops, shows that when by external aid plants have been brought to a certain development of root and leaf they are then able to gather a good share of their nourishment from this soil.

The failure of these meadows to give a good crop of good grass may not be altogether due to lack of plant-food. The texture and physical qualities of the soil exercise oftentimes a controlling influence on the kind and amount of vegetation which it supports. Simple drainage and deep tillage which can have no immediate effect on the quantity of the elements that are commonly regarded important to fertilizers or to the soil, often renovate the field by removing too much water and admitting more air, and thus deepening the available tilth.

As Mr. Porter says, "the soil is sick and it must be built up the same as animals when sick." Now the physician when called to a patient will first assure himself that the sanitary conditions are what they should be:—that is, that his patient is warm and dry and his system in a condition to respond to medicine when it is given. If he is not comfortably placed, medicine may do no good and rather aggravate than improve his condition. To carry out the simile, in building up sick land the rule should be, first of all, to make sure that its physical condition is what it should be, and if it is too wet or cold, too compact or too leachy, to remedy these defects by tillage, drainage and the use of amendments. When that is done, we may apply medicine, in the form of fertilizers, if indeed the land does not recuperate without them, but if it is not done little benefit is to be expected from any amount of fertilizers.

This is what Mr. Porter has done with gratifying success. Under date of Nov. 24, 1882, he writes: "We plowed 6 acres in June (1881), harrowed and sowed to buckwheat. The seed did not germinate well, although a neighbor who had some of the

same seed got a good crop. This plowed ground on examination developed the reason why the buckwheat did not respond. It was this: the June grass turf is much like a sheepskin with the wool on, turned over, the moisture could not come up through the tough soil. But the following spring it was plowed and stocked down with oats, red top and clover. The oat crop was good, the grass seed made a good catch and last October the red top was six to eight inches high. There are hundreds of acres of this kind of land in the northeastern portion of the United States, and Connecticut especially has her share. According to your analysis, what is now called the poorest soil, almost worthless, is actually a small mine of wealth if nature is aided in throwing off the water; and the plow will frequently do the important part."

## On Reducing Bones with Ashes.

On page 67 of the last report, in discussing this subject it was advised to use gypsum (land plaster) in making a compost heap of bones and ashes. The action of the ashes on the bone is due to the alkaline qualities of their carbonate of potash or of the caustic potash which results from its mixture with quicklime. The use of gypsum was suggested by the fact that this substance is a preservative of animal matter and would tend to prevent waste of nitrogen.

Professor E. W. Hilgard, of San Francisco, Cal., has kindly called my attention to the fact that gypsum (sulphate of lime) destroys the solvent effect of ashes on the bone tissue, as he has found by actual trial, and as must be anticipated from the well-known chemical changes which take place between sulphate of lime and carbonate of potash when they are dissolved together in water. They yield in fact carbonate of lime and sulphate of potash which are quite without effect on the bone.

## SALT AND SALTPETRE FOR PRESERVING FOOD.

The following questions were propounded by the Wilton Farmers' Club, through its secretary, D. H. Van Hoosear, Esq.:

"Our Club has had much discussion upon "Butter Salt" and "Saltpeter." I send you to-day samples of both, which please analyze and report upon. Some complain of butter, pork, &c., not keeping; others of brine not being salt enough, yet salt in the barrel.

Could we trouble you to answer the following questions:

1. What is the saving property of salt?

2. What is meant by salt "losing its savor?"

3. Do you find anything detrimental to the keeping of butter, pork, &c., and if so, what, in the samples of salt sent herewith?

4. Is lime in salt injurious to its keeping qualities for butter, pork, &c.?

5. Can salt be *too* fine for salting butter?

6. Which do you think (according to samples) is the best for butter?

7. Is Turk's Island salt as good as rock salt for preserving pork?

(Please give us a standard to go by.)

8. Has saltpeter preserving qualities, and why do we use saltpeter in preserving pork and hams? What effect does it produce on pork and hams?

9. How can we tell an adulterated or impure article of salt or saltpeter?

(One man describes some as "soapsuds," when dissolved in water.)"

*Answers.*

"1. What is the saving property of salt?"

The putrefaction, or spoiling of meat, and probably also, the rancidity of butter, are caused by microscopic organisms, probably vegetable in their nature, which are latterly known in science as *bacteria*. If the growth and multiplication of these organisms is hindered or prevented, putrefaction and rancidity are correspondingly checked or altogether stopped.

A great variety of substances, such as vinegar, carbolic acid in coal tar, kreosote in wood smoke, camphor, oil of cloves, spirits of turpentine, arsenic, tannin, salicylic acid, sulphurous acid, and

other so-called antiseptics arrest decay, and putrefaction by paralyzing or killing the minute living things whose development appears to stand in the closest relation to these changes.

In the preservation of food we can use only such antiseptics as do not interfere with its proper uses and as are at the same time cheaply and generally obtainable. For common uses, "common salt" is most applicable because of all salts it is the cheapest and has the least injurious effect on the health of man, small quantities of it, as an addition to food, being in fact beneficial to health as well as agreeable to the taste.

The antiseptic effect of salt is only fully manifested by a nearly saturated solution of it in water, *i. e.* by a strong brine. When dry salt is sprinkled over meat it shrinks the fiber of the flesh and expels its juice. A strong brine acts in a similar manner and itself becomes thereby diluted. When pork spoils after salting, it is because there is not salt enough where the spoiling occurs, although surplus of salt exists near by.

Brine in which beef has been corned will taint in warm weather unless it is kept saturated by addition of more salt and frequent stirring. Pure salt and also a brine saturated with salt, will gather moisture rapidly from cool damp air, such as often exists in cellars.

The effect of this "hygroscopic" quality of salt is to make a brine grow weaker at the top, and consequently pork which is but just covered by brine, may, on long standing, become tainted, although there is plenty of salt in the barrel. Either more salt should occasionally be sprinkled over the meat or the access of moist air should be prevented by a close cover.

2. Biblical scholars, I believe, explain the passage "Losing its savor," as follows:

The salt used in the New Testament times was obtained by natural evaporation of salt water, and was a good deal mixed with fine earthy matters, clay, etc. When exposed to rain, the salt was dissolved away and the clay remained, having much of the appearance of the original material, but really containing little or no salt, and having therefore lost its savor or taste. Now that we so universally use a very pure salt, the losing or apparent losing of its savor becomes quite impossible.

3. "Do you find anything detrimental to the keeping of butter, pork, etc., and if so, what—in the samples of salt sent herewith?"

Here follow the results of partial analyses of the samples of salt and a statement of their composition, as calculated from the results of analysis. On dissolving the samples in water, only very minute, scarcely weighable, quantities of foreign matters remained undissolved. They are therefore as clean from dirt and mechanical impurity as could be desired.

### Chemical Analyses of Samples of Salt

Sent by D. H. Van Hoosear.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| | Deakens Salt. Finney & Benedict, Norwalk. | Ashton Salt. Selleck Bros. Norwalk. | Higgins Salt. H. K. & F. B. Thurber & Co. New York. | Phœnix Fact'y-filled Holmes & Keeler. Norwalk. | Holmes Salt. J. C. Rockwell. Wilton. |
| *Results of partial Analysis.* | | | | | |
| Water at 100° | 0.69 | 0.71 | 0.48 | 0.77 | 0.37 |
| Lime | 0.67 | 0.65 | 0.62 | 0,66 | 0.55 |
| Magnesia | 0.10 | 0.09 | 0.11 | 0.09 | 0.07 |
| Sulphuric Acid | 0.92 | 0.82 | 0.83 | 0.85 | 0.84 |
| *Composition calculated from the above Analytical Results.* | | | | | |
| Water at 100° | 0.69 | 0.71 | 0.48 | 0.77 | 0 37 |
| Sulphate of Lime | 1.56 | 1.40 | 1.41 | 1.45 | 1.33 |
| Chloride of Calcium | 0.06 | 0.14 | 0.08 | 0.12 | --- |
| Sulphate of Magnesium | --- | --- | --- | --- | 0.09 |
| Chloride of Magnesium | 0.24 | 0.21 | 0.26 | 0.21 | 0.10 |
| Chloride of Sodium—Salt | 97.45 | 97.54 | 97.77 | 97.45 | 98.11 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

The composition given is calculated in the manner believed to express most truly the real state of combination of the elements present. *Sulphate of lime* exists in all the samples to the extent of 1.33 to 1.56 per cent. These quantities are practically the same, for the sulphate of lime is tasteless and, in these amounts, without any sensible effect on the quality of the salt.

The three compounds chloride of calcium, chloride of magnesium and sulphate of magnesia, may be classed together, as they are highly soluble bodies with a bitter taste, and so far as I know, are essentially alike in their influence upon the quality of the salt. Of these we observe that the first four samples contain almost identically the same amounts, 30 to 35 ten-thousandths. In the 5th sample they are present in smaller proportion. The latter sample also contains less moisture and from one-third to two-thirds of one per cent. more pure salt than the other samples.

6

It would be too much to say that these analyses of single small samples establish any even slight superiority of the brand represented by 5 over the others. Several analyses of samples manufactured at different times would need to be made in order to give a fair exhibit of the composition of the various brands. Two analyses of Ashton salt, which I am able to refer to, made by Prof. Cook and Prof. Gœssman, in 1861, give but 11 and 6 ten-thousandths of magnesium chloride and sulphate, without any calcium chloride. The manufacturing process scarcely admits of entire uniformity in the result.

The sulphates and chlorides of calcium and magnesium are all, in themselves considered, objectionable ingredients of salt, because they are foreign matters and not salt. With exception of sulphate of lime they are objectionable on account of their unpleasant taste. The chlorides of magnesium and calcium are further objectionable in table salt, because they greedily attract moisture from the air and make the salt damper than pure salt would become.

A salt containing several per cent. of these bodies would be regarded as quite unfit for dairy use. The presence of a few thousandths of them in salt has, however, no appreciable effect on the taste of salt or on the articles it is used to preserve or to flavor. Just to what point they may be increased in quantity without real detriment to the salt, *i. e.* without noticeably injuring it for its common uses is a nice point to determine. Doubtless each of the samples under consideration is, so far as chemical composition goes, a good salt suited for butter-making, for pork or beef packing or for any domestic purpose, and a tenth of one per cent. of all or any of the sulphates or chlorides of magnesium or calcium added to or taken from them would not be recognizable by any of the results of their use. This opinion is not based on any careful comparative trials of various salts of slightly differing purity, but upon the facts that the kinds of salt generally used rarely contain less and often contain more impurities than these analyses reveal, and that these impurities in these quantities are not recognizable by the taste.

4. "Is lime in salt injurious to its keeping qualities for butter, pork, etc.?"

Lime, as quick lime or slacked lime, I suppose, does not impair the *keeping quality* of the salt, but injures the taste or flavor of the articles salted, and, in case of butter, the appearance. Lime

is sometimes employed in salt manufacture, to purify the brine, and some years ago, I believe, salt containing slacked lime, got into market and damaged or was thought to damage a large quantity of butter. The mistake is of so serious a kind to the salt-makers that it will not be likely to occur again.

5. "Can salt be *too fine* for salting butter?"

Yes; salt may be too fine or too coarse, for such use. Fresh churned butter contains a quantity of the milk-serum (butter-milk) which it is one object of salting to remove. When salt is worked into butter each grain of salt gradually dissolves in the butter-milk and withdraws it from the butter, probably shrinking the bulky, jelly-like casein just as salt mixed with a jelly of soap shrinks the soap into a small, firm cake, and unites with the water to make a brine. If the salt be very fine the result is to fill the mass of butter with a multitude of very small drops of brine which are difficult to work out of the butter. On the other hand, if the salt be very coarse the butter-milk will gather in large drops, easy to work out, but the salt grains will not be entirely dissolved and will make the butter too salt and gritty to the taste. The proper fineness, therefore, is that which comes just short of occasioning the last-named difficulty, so that by its use we remove the butter-milk thoroughly, without leaving any unpleasant surplus of salt in the butter.

The Ashton butter-salt, and the Syracuse factory-filled dairy-salt, are commonly reputed to have the degree of fineness suitable for dairy use. According to Alexander Müller, the grains of a good dairy salt should have dimensions lying for the most part between $\frac{1}{25}$ and $\frac{1}{50}$ of an inch in diameter ($\frac{1}{2}$ and 1 millimeter).

6. "Which of the kinds of salt sent do you think (according to the samples) the best for butter?"

The mechanical analysis of these salts is as follows:

| | Deakens. 1 | Ashton. 2 | Higgins. 3 | Phœnix. 4 | Holmes. 5 |
|---|---|---|---|---|---|
| Coarser than 2 millimeters, | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 |
| Between 2 and 1.5 " | 6.0 | 4.4 | 0.0 | 3.6 | 0.0 |
| " 1.5 " 1.0 " | 11.9 | 10.9 | 1.0 | 10.8 | 2.2 |
| " 1.0 " 0.5 " | 16.9 | 20.8 | 13.0 | 17.5 | 6.0 |
| Less than 0.5, | 65.2 | 63.9 | 86.0 | 67.3 | 91.8 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

It will be seen that the Deakens, Ashton and Phœnix salt are quite alike as to mechanical condition. Higgins' and Holmes' salt are very considerably finer.

Alex. Müller (Landwirthsch. Versuchs-Stationen, 1863, Bd. V, S. 187) proposes to test the value of salt by sifting it as above, and values it according to the amount *held on the sieves.* By this test **1**, **2** and **4** would be considered better than **3** and **5**, the chemical composition of all five kinds being essentially the same; but it is evident that much depends on the way in which the butter and salt are worked together; and while a moderately coarse salt may answer best for the first object of salting, viz: to withdraw the buttermilk, a finer grade may be better suited to the other object, the preservation and seasoning of the butter. What is considered the best dairy salt in Germany is mostly coarser than 0.5 millimeter.

7. "Is Turk's Island salt as good as rock salt for preserving pork?"

The two kinds of salt are essentially the same. The Turk's Island has a good reputation, and though commonly containing some "dirt," its impurities are not of the kind to impair its preserving quality or to injure pork or beef.

8. "Has Saltpeter preserving qualities, and why do we use it in preserving pork and hams?"

Saltpeter has similar preserving qualities to common salt. Being much more expensive, it is not used for preserving simply, but because it gives a red color to lean meat. Saltpeter in much quantity is very injurious to man, and but little should be used in preserving meat intended for human food.

9. "How can we tell an impure or adulterated article of salt or saltpeter?"

Good salt for dairy use should dissolve in water, making a clear or very nearly clear brine. The coarse Turk's Island salt is sometimes very dirty and makes a brine that might be said to look like soap-suds. The same is often true of cheap unrefined saltpeter. Such a brine when strained through a fine cloth or let settle, may be used for preserving meat. It is better, however, to use salt and saltpeter refined from such impurities. The objectionable chlorides of calcium and magnesium if present in much quantity, may be recognized by the bitterness which they give to the salt, but if their amount is small they can only be detected by the chemist's tests.

## POISONS.

### Case of Suspected Poisoning.

"Hartford, May 24th.

"Dear Sir: I have sent you by express a sample of the intestines of a cow that died under very suspicious circumstances, May 2d, after a week's illness, where all the symptoms pointed to an enteric difficulty. The heifer had been injured on the side just back of the forelegs, while it was being shipped from Massachusetts, and the internal result was apparent on post-mortem examination by way of exudations, adhesions, etc. Yet the reddened, softened, and excoriated condition of the mucous membrane of the stomach and bowels could hardly be accounted for by the injury. I called attention to this point at the examination and inquired if she could have eaten any poisonous substance, paint, etc. Blood in large clots, a pint or more, was found in the first stomach or paunch. There was a peculiar appearance about the food, which was of a greenish aspect.

"There being no clue to poison and a great paucity of active symptoms, I was nearly persuaded to believe that she died from the effects of the injury. But Col. Rathbone, of Lenox, Mass., from whose herd this animal came, has since lost six head, with similar symptoms, and clots of blood in stomach, so reports say: and it is claimed they were all poisoned. This at once strengthened my suspicion and we exhumed the carcass last Thursday and obtained the specimens sent you. The odor is somewhat subdued by carbolic acid. These are the facts, and I should like to have you test the question and report at an early date. N. Cressy."

The material sent by Dr. Cressy was submitted to a careful examination by Dr. Herbert Smith of the Yale Medical School. Special attention was directed towards poisonous metals such as might exist in paint, to oxalic acid and to vegetable poisons; but no indication of any poisonous substance was obtained.

## Galvanized Iron as a Source of Poison.

Galvanized iron is sheet iron coated with zinc. The latter metal dissolves with great ease in all acids, so that when the juices of fruits or vinegar are put in contact with it the zinc disappears and the juices become impregnated with soluble zinc compounds. Several instances have been reported to the Station where cider has been boiled down in galvanized iron pans with the effect above stated, and the question has arisen whether the cider has thereby become poisonous.

The soluble salts of zinc are certainly not wholesome and are properly ranked among poisons. They are not however an active poison when taken in small doses; and a little zinc dissolved in cider may produce no noticeable ill effects on a vigorous person. Large doses cause disturbance, more or less serious, of the digestive apparatus. Sulphate of zinc, for example, is sometimes used as an emetic. Persons of delicate constitution or in feeble health may be seriously injured by quantities of zinc or other poison which would not perceptibly harm strong and healthy people; and cider or other acid liquids containing zinc should always be looked upon as probably dangerous and their use for domestic purposes should be carefully avoided.

## Tinned Copper, so-called, a Source of Lead Poison.

The Station having occasion to use a vessel of tinned copper for the storage of distilled water ordered one made of a tinsmith in New Haven. The vessel proved totally unfit for its use as the copper was lined not with tin but with an alloy containing so much lead that pure water dissolved it rapidly and carbonate of lead in minute brilliant crystals formed a film on the surface of the water and coated the sides of the vessel.

The tinsmith was unaware of the dangerous nature of the copper, and explained that it was a regular article of manufacture coming from Ansonia in this State. Such metal may be useful for many purposes but is totally unfit for cooking utensils, tea-kettles, etc., and very serious or even fatal consequences may result from its use in the household.

# MILK.

By Dr. E. H. Jenkins.

During the last two years the Station has been called upon to make a large number of milk-examinations, partly for retail buyers and sellers, and partly in the interest of the creameries in the State. Between 200 and 300 complete or partial analyses have been made, but only those are referred to here which are believed to be of general interest.*

Before entering into the details of the Station work on the subject of milk, we give a brief outline of the composition of that liquid and of the two methods which serve as tests of its quality.

### Chemical Composition of Milk.

An "average" analysis of milk is as follows:—

| | | |
|---|---|---|
| Water, | | 87.5 |
| Fat, | 3.5 | |
| Casein and albumin, | 4.1 | |
| Milk sugar, | 4.3 | |
| Ash, | 0.6 | |
| Solids, | | 12.5 |
| | | 100.0 |

* *Method of Analysis.*—As the methods of milk analysis used by chemists, differ somewhat, a brief description of the process employed at this Station is given. *Specific gravity* is determined in all cases by the Jolly spring balance. *Water* is determined by drying a weighed quantity of milk, about 1.8 grams, in a weighed capsule containing 10 or 15 grams of washed and ignited sand, till the weight is constant. The contents of the capsule remaining from this determination are transferred to an extractor and the *fat* extracted with absolute ether. The fat is finally dried in a steam bath at 100° C. and weighed. Another weighed portion of milk is dried over the water bath in a capsule of thin glass, capsule and milk residue are pulverized and mixed with soda lime and the nitrogen determined in the usual way. "*Casein*" is reckoned from the amount of nitrogen found, by multiplying by the factor 6.25. This of course includes the albumin and all other nitrogenous matters of the milk. It is only approximately correct, but the results serve for comparing different samples of milk and the method is in general use. The factor 6.4 would no doubt give a closer approximation to the actual amount of nitrogenous matter.

*Milk sugar* is determined in 8–10 grams of milk, after removing fat and nitrogenous matters by means of copper sulphate and sodium hydrate—(Fresenius' Zeitschrift, 1878, p. 242) by Tollens' method—(Fres. Zeitschrift, 1879, p. 605.) *Ash* is estimated by difference only in those cases where all the other ingredients have been determined.

Water is the most abundant and a necessary, though of itself a worthless ingredient. It constitutes on the average seven-eighths of the total milk, but varies several per cent. from that mean. The valuable ingredients are included in the 12.5 per cent. more or less of matters which remain in the solid state when the water is evaporated off.

All these solids are valuable as food.

Butter is the fat of milk mixed with some 10 or 15 per cent. of water and 1–2 per cent. of the other solids of the milk, together with 2–5 per cent. of salt added in the making.

Butter-milk is the water of milk, with most of the casein and sugar and a small amount of fat.

Cheese is the casein and albumin of milk, with more or less of the fat and other solids and a variable amount of water.

Whey is mostly the water of milk, with the larger share of the sugar and small portions of the other solids.

The worth of milk for common use as food depends on the quantity of solids it contains. It is well established that genuine milk is somewhat variable in composition as respects the proportions of water and solids. It is found that differences of breed, characteristics of the individual animals, period of lactation, quantity and kind of food, climate or weather, state of health and other conditions, which largely affect the quantity or yield of milk, also, though to a much less degree, influence its composition or the proportion of its ingredients.

Milk is also made to depart from the average composition given above, by willful falsification, either by skimming off part of the cream, by adding water directly to the milk or by both operations together. It is difficult to distinguish by simple inspection or ordinary tests, between rich and poor milk, between genuine and moderately adulterated. On the one hand two samples of milk which appear to be different in richness as judged by the color and the rapidity with which the cream rises, may be essentially alike in composition and equally good for cheese-making or for immediate consumption as food. On the other hand, a small amount of watering, and the removal of a part of the cream may escape suspicion and defy detection by the ordinary means.

It is very important therefore to know what are the natural and ordinary limits of the variations in the composition of milk, and how to distinguish such variations from those which result from intentional watering or skimming.

*Tests of the quality of milk.*—Various methods have been proposed for testing the quality of milk. Of them all, there are but two which are to be depended upon; one of these is the specific gravity (or density) test, the other, chemical analysis.

*The specific gravity test* is the one commonly employed in the control of market milk, by Boards of Health and police authorities. Milk is, bulk for bulk, slightly heavier than water. A vessel that will contain 1000 grains of water will hold 1029 to 1034 grains of milk. The lactodensimeter, commonly called the lactometer, is a glass spindle with a slender stem marked off into degrees which sinks in milk to different depths according to the specific gravity of the liquid, which can be read from the scale. This instrument, properly constructed and skillfully used, gives the specific gravity, with great accuracy, by a single observation.

Milk is made heavier than water by those of its ingredients, which are heavier than water, namely: casein, albumin, sugar and ash. The fat of milk is lighter than water, and tends to reduce its specific gravity, so that the specific gravity of milk is diminished by adding water and increased by removing fat. Unless, therefore, milk is falsified both by watering and skimming, the specific gravity serves to indicate very exactly its genuineness and its richness.

If milk is watered to any considerable extent, its specific gravity is brought below 1.029 and the lactodensimeter promptly detects the addition. If, however, the milk first be skimmed or the top poured away after some hours' standing, the skimmed or bottom milk will show a high specific gravity and a considerable addition of water may be made without reducing the specific gravity below that of pure milk. Such double falsification of milk requires for its detection that the sample shall be let stand for cream or that chemical analysis shall be resorted to.

*The test by chemical analysis* is the only absolutely conclusive means of ascertaining the quality of milk. A determination of the solids of milk by evaporating off the water from a known quantity and weighing the residue, will decide whether milk has been watered or the cream removed, and combining both of these frauds only makes the detection of them more certain. If we separate and weigh the fat, the casein and the sugar of a sample of milk, we get an accurate notion of its composition. Ordinarily the determination of the solids and fat suffice for all practical purposes.

The only embarrassment which these tests do not relieve us from, is that occasioned by the natural variations in the composition of milk. The limit of such variation is discussed in the pages that follow.

## Analyses of Guernsey Milk.

In the table on page 82 are given analyses of the milk of single Guernsey cows of pure breed, owned by Mr. E. Norton of Farmington, Secretary of the American Guernsey Cattle Club. The samples were drawn from the morning's milk. The cows were milked twice daily, morning and evening, between five and six o'clock.

For comparison, the average of these analyses is given below, with the averages of some milk analyses made at the New Jersey Experiment Station in 1880, by the same method which has been employed here. (See the New Jersey Station Report for 1880, p. 59). In the case of each New Jersey herd, 13 analyses were made on as many consecutive days.

| | | Made at the New Jersey Station. | | |
|---|---|---|---|---|
| | Guernsey. 6 Cows. | Jersey. 6 Cows. | Ayrshire. 5 Cows. | Native. 6 Cows. |
| Water, | 85.20 | 85.28 | 87.15 | 86.43 |
| Solids, | 14.80 | 14.72 | 12.85 | 13.57 |
| Casein, | 4.08* | 3.67 | 3.20 | 3.34 |
| Fat, | 5.23 | 5.21 | 4.33 | 4.49 |
| Sugar, | 4.50* | 4.93 | 4.60 | 4.82 |
| Ash, | 1.17* | .91 | .72 | .92 |
| Daily yield per head, | | 21 lbs. 3 oz. | 21 lbs. 4 oz. | 22 lbs. 9 oz. |

* 10 analyses.

The yield of the Guernsey cows is not known.

The cows of the Ayrshire herd had not been quite so long in milk as the natives. The Jerseys had been longer in milk than either of them.

These figures are here given simply as a contribution to our knowledge of the chemical composition of cows' milk, as affected by the breed. A few results like these, *taken by themselves*, prove very little with regard to this point. In the first instance variations in the chemical composition of milk, like differences in the milk yield, are *individual* peculiarities. By breeding, such differences have, to a greater or less degree, been made permanent and constant; but even within the same breed we still find large

### Analyses of Milk of Guernsey Cows. Dairy of Mr. E. Norton, Farmington.

| Name of cow | Gloriana. | | | Princess. | | | Ceres. | | | Fawn. | | Lemon. | | Amy. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date. | Nov. 15. | Dec. 8. | May 16 | Nov. 15. | Dec. 8. | May 16 | Nov. 15. | Dec. 8. | May 16 | Nov. 15. | Dec. 8. | Nov. 15. | Dec. 8. | May 16 |
| Sp. Gr. | 1.0326 | 1.0354 | ---- | 1.0334 | 1.0354 | ---- | 1.0340 | 1.0368 | ---- | 1.0340 | 1.0340 | 1.0353 | 1.0368 | ---- |
| Water | 85.02 | 84.98 | 86.36 | 86.63 | 85.90 | 87.19 | 82.85 | 82.94 | 84.86 | 84.96 | 86.05 | 84.82 | 85.52 | 84.66 |
| Solids | 14.98 | 15.02 | 13.64 | 13.37 | 14.10 | 12.81 | 17.15 | 17.06 | 15.14 | 15.04 | 13.95 | 15 18 | 14.48 | 15.34 |
| Casein | 4.22 | 4.13 | ---- | 4.16 | 3.69 | ---- | 4.51 | 4.60 | ---- | 4.14 | 3.77 | 4.00 | 3.55 | ---- |
| Fat | 5.00 | 5.47 | 4.39 | 4.00 | 4.77 | 4.05 | 6.62 | 6.74 | 6.04 | 5.23 | 4.73 | 5.06 | 5.06 | 6.22 |
| Sugar | 4.47 | 4.42 | ---- | 4.18 | 4.39 | ---- | 4.57 | 4.52 | ---- | 4.62 | 4.35 | 4.69 | 4.76 | ---- |
| Ash | 1.29 | .79 | ---- | 1.03 | 1.25 | ---- | 1.45 | 1.20 | ---- | 1.05 | 1.10 | 1.43 | 1.11 | ---- |
| Date of dropping last calf | March 8, 1882. | | | April 21, 1882. | | | March 23, 1882. | | | Slipped her calf last spring. | | April 26, 1882. | | Nov., 1881. |

variations in yield and quality of milk due to individual differences in cows. For example, the Guernseys have been isolated more completely and bred under more uniform conditions perhaps, than almost any other class of cattle. Yet the milk of Ceres in the table here given, differs as widely from that of the other Guernseys in percentage amount of fat as the average Guernsey milk differs from the Ayrshire in the foregoing comparison.

## Analyses of the Mixed Milk of Herds.

During the last year over 200 partial analyses of this kind have been made for creameries in this State. The object has been partly to detect any adulteration but more particularly to furnish some guide for fixing the price to be paid by the creameries to their different patrons for milk. As was to be expected, the managers of creameries everywhere find very great differences in the butter-producing quality of milk from different herds, and both abroad and in this country an effort is being made to scale the prices paid according to the quality of the milk. Two methods are in use for testing the butter yield of milk, namely:—1. churning trials on a small scale, and 2. determinations of the fat by chemical examination. Churning tests require considerable time of the workmen in the creamery, and are not absolutely reliable, because it is not easy to work all samples exactly alike and some of the butters may contain more water and butter-milk than others, which would make the apparent yield larger.

The objections to chemical examination are that it requires a special skill not always at command, and that its results are not perfectly conclusive because the butter yield does not depend alone on the amount of fat in the milk, but also on the size of the fat globules, the quality of the milk serum, and perhaps on still other factors. Creamometer tests and optical tests are quite unreliable, and are not taken into account here.

It was objected by some of the creamery patrons that in their own dairies they got a larger butter yield from their milk than was got in the churning tests at the creamery, and it was this objection partly which led to the carrying out of the milk analyses at the Station. It then appeared that in some cases dairymen got a good deal more butter from their milk than there was of actual fat in it, which clearly indicates that their home-made butter contained considerable water or buttermilk, and probably

more than creamery butter.* Perhaps this would be no disadvantage if the butter was used at once, but it would seriously damage its keeping quality.

It is quite evident that quality as well as quantity should be regarded in the sale of milk, and a scale of prices regulated somewhat by the quality will no doubt operate beneficially on all parties. It will then be the aim of all owners of cows to get the richest milk, and not simply the largest yield, without regard to its richness, which latter aim is the chief incentive to adulteration.

Further investigation will be needed before the Station can render the most efficient aid to creameries, milk-producers and milk consumers, but much valuable preliminary work has been already done.

A brief summary of the analyses so far made will be of interest as bearing on the matter of the milk supply of our cities and the tests of the purity and genuineness of milk.

30 analyses of the milk of 12 herds, about 180 head of cows, made in October, 1881, gave:

| | Solids. | Fat. |
|---|---|---|
| Average, | 12.89 | 4.02 |
| Maximum, | 14.28 | 5.14 |
| Minimum, | 12.00 | 2.68 |

27 analyses of the milk of the *same herds*, made in July and August, 1882, gave:

| | Solids. | Fat. |
|---|---|---|
| Average, | 12.21 | 4.23 |
| Maximum, | 13.32 | 5.63 |
| Minimum, | 11.02 | 3.47 |

77 analyses of the milk of 60 herds made in May, 1882, gave:

| | Solids. | Fat. |
|---|---|---|
| Average, | 12.81 | 4.05 |
| Maximum, | 14.44 | 5.23 |
| Minimum, | 10.93 | 3.24 |

* The variations in the composition of genuine well-worked and unsalted butter are, according to Fleischmann, as follows:—

| | | |
|---|---|---|
| Water, | from 8 to 18, | average 14 per cent. |
| Fat, | from 80 to 90, | average 84 per cent. |
| Other solids, | from 0.8 to 2.4, | average 1.5 per cent. |

In the creameries it is usual to set the milk for a fixed time only, say 24 hours, while in domestic practice the milk is skimmed during 36 or 48 hours. In case of Jersey and Guernsey milk and generally milk with large fat-globules whose cream rises quickly, the creamery and home tests should agree; but with milk of those breeds which are characterized by small fat-globules, there might be from this cause a considerable discrepancy.

103 analyses of 55 herds made in July and August, 1882, gave:

| | Solids. | Fat. |
|---|---|---|
| Average, | 12.08 | 4.03 |
| Maximum, | 13.83 | 5.63 |
| Minimum, | 9.79 | 2.60 |

The average of 208 analyses of herd milk is:

| | |
|---|---|
| Solids, | 12.40 |
| Fat, | 4.02 |

The results just given show that in the herd-milk examined at this Station, solids varied between 14.4 and 9.8 per cent., and fat between 5.6 and 2.6 per cent. In only one case were the solids below 10 per cent. and in that instance the fat was 3.1 per cent. In 5 cases solids were between 10.0 and 10.5, the fat ranging from 3.1 to 3.5. (Two of these cases represent milk of the same herd.) In 6 cases solids were between 10.5 and 11.0, the fat ranging from 2.8 to 3.9. (One case is the same herd that gave solids below 10 per cent.) In 19 cases the solids fell between 11.0 and 11.5, the fat between 2.6 and 4.5. In 27 cases solids ranged between 11.5 and 12.0, fat between 3.3 and 4.7 per cent. In the other 150 cases the solids were above 12.0 per cent., and the fat ranged from 3.4 per cent. upwards.

| | Cases. |
|---|---|
| Solids below 10 per cent. | 1 |
| Solids between 10 and 10.5 per cent., | 5 |
| Solids between 10.5 and 11.0 per cent., | 6 |
| Solids between 11.0 and 11.5 per cent., | 19 |
| Solids between 11.5 and 12.0 per cent., | 27 |
| Solids above 12.0 per cent., | 150 |
| | 207 |

Unfortunately it was not possible to make determinations of specific gravity in the samples here examined. In no case was there any apparent sickness among the cows. The larger number of the cows in these herds were grade Jerseys; but there was also a considerable number of natives, Jersey thoroughbreds and Guernseys.

There is no *absolute certainty* that some of these samples were not either watered or diluted with skimmed milk. It is hard to believe that a milk with only 9.8 per cent. of solids has not been tampered with; on the other hand, it is not reasonable to suspect that the milk of between 50 and 60 herds of cows has been systematically "doctored," to reduce the solids below 12 per cent., the minimum figure below which it has been assumed by some

that pure milk never falls,* without this being in any case so clumsily done as to reveal the cheat at once by analysis, or to disclose the knowledge of it to some one in the neighborhood who would bring it to the notice of interested parties.

Considering too, that self-interest as well as common honesty would tend to prevent such fraud in dealings with a company that watched its patrons closely, we cannot do otherwise than accept the majority of these samples as being pure milk.

In a considerable number of these cases we have seen that the per centage of fat and more especially of solids varies widely from the average per centage in milk as given on page 79. Others have found similar variations.

W. Fleischmann (Jahresbericht über Ag. Chem., 1880, 487), found as the annual average in the morning milk of 4 herds of cows, 4 head in each herd, 11.67, 11.89, 11.97 and 11.41 per cent. of solids with 3.2, 3.4, 3.4, 3.2 per cent. of fat respectively. The specific gravities were 1.032, 1.031, 1.0318 and 1.0304. In the evening milk of the same cows he found 11.76, 12.2, 11.97, 11.39 per cent. solids, with 3.0, 3.4, 3.3, 3.0 per cent. fat, and specific gravities 1.0323, 1.0318, 1.0322, 1.0309. In these cases one analysis each of morning and evening milk was made every three weeks; and the cows being under the personal superintendence of the experimenter, the results are perfectly trustworthy.

Dr. Schmœger (Milch-Zeitung, 1881, 787), gives the results of extended observations on the yield and quality of milk from a herd of 45 Dutch cattle in Proskau, from October 15, 1878, to March 31, 1881. The average yield per head from October, 1878, to October, 1879, was 2864 quarts, from October, 1879, to April, 1880, (a half-year) was 1418 quarts, and from April, 1880, to April, 1881, was 2973 quarts. The cows were milked 3 times daily: at 4 and 11 A. M. and 6 P. M. The observations on the *quality* of the milk were as follows:

* For example, the New Jersey State Law declares that milk which contains less than 12 per cent. of solids shall be considered as adulterated. The British Society of Public Analysts have adopted as the minimum proportions of constituents in unadulterated milk 11.5 per cent. of solid and 2.5 per cent. of fat. By the New Jersey law, 28 per cent. of the samples of herd milk here analyzed during the year would have been condemned, by the British Society's standard nearly 15 per cent.

| | Morning Milking. | | | Noon Milking. | | | Evening Milking. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Av. | Min. | Max. | Av. | Min. | Max. | Av. |
| Specific gravity | 29.2* | 34.0 | 32.0 | 29.1 | 34.0 | 31.2 | 29.9 | 34.5 | 31.9 |
| Solids | | | 11.31 | | | 11.85 | | | 11.77 |
| Fat | | | 2.79 | | | 3.41 | | | 3.26 |

* Read 1.0292—1.0340, etc.

During one period of six months the average percentage of solids was 11.19 in morning milk, in another period, noon milk had 11.75, and in a third, evening milk had 11.75.

*Variations in Milk Solids.*—An inspection of all the results above given leads to the conclusion that in pure herd milk the solids may in some cases and at certain seasons sink as low as 10.0 or 10.5 per cent. and the fat to 2.6 per cent.: and that very frequently, (in 28 per cent. of the samples examined at this Station), the solids are less than 12.0 per cent.

In more than 6000 recorded observations on the mixed milk of herds, Bouchardat and Quevenne found that it was always between 1.029 and 1.033. Müller in Bern, from many hundred observations in Switzerland, France, Belgium, England and other places, found the same limits. Fleischmann, in 833 samples of milk sold in Lindau, found only 4 per cent. which had a specific gravity of less than 1.029, and all of these, as he proved, were either from single cows or had been watered. In the reports of examinations made by the police of European cities of herd milk taken in the stables, it is possible to find specific gravities under 1.029, but in these cases there is no certainty or even probability that the determinations were made with sufficient care to avoid sources of error.

It is a matter of great importance to know, not simply what is the average composition of herd-milk, but what composition it may have; what are the limits within which all pure herd-milk comes; and whether it is practicable to establish by law, or by regulation among dealers in milk, a standard of composition which shall distinguish pure milk from that which is watered or skimmed, or at least which shall distinguish between that which is marketable and that which is of too poor a quality to be offered for sale. A consideration of the observations noticed above brings us to the following conclusions with regard to the value of *total solids*, and of *specific gravity*, as criteria for judging of the quality of milk.

We have seen that pure herd-milk shows very wide variations

in its content of solids and fat, and variations less striking in its specific gravity. No instance appears to be on record where a competent observer has found for the mixed milk of a number of healthy cows a specific gravity less than 1.029, and we may conclude with certainty, that milk which falls below that density has been watered.

As evidence of watering simply, specific gravity furnishes by far the most satisfactory test, and if 1.029 is adopted as a minimum, no pure milk will be condemned. In some cases moderately watered milk may escape detection.

If we will establish a minimum limit for the percentage of solids and fat which shall in no case condemn pure milk in any locality, we shall have to make it absurdly low, and thus offer a premium on watering milk of good quality.

As between producers and creameries, or wholesale dealers, in any given locality, it is, we believe, perfectly practicable and fair to establish a standard of chemical composition and require that no milk shall be sold which falls below it. In order to establish such a standard, numerous analyses of herd-milk must be made at different times through the year, the samples to be taken from a considerable number of herds; so as to have a clear idea of those variations which are to be expected in that locality, with the changes of the seasons and the feeding. If fairness and accuracy are aimed at, dependence cannot certainly be placed on the results of analyses made in other places, where the popular breeds of cows, the climate, food, and management of cattle are, or may be all different. In such an arrangement it will be seen that "adulteration" will never have to be claimed or proved. The question is simply one of chemical composition and is easily settled.

Of late *skimmed milk* has come to be sold extensively in the cities of this State, being bought at low rates, wholesale, from the creameries by milk dealers, and is too often sold as "whole milk" to the disadvantage of purchasers and the serious embarrassment of milk producers; for it is impossible for an honest milk-man to compete with a dishonest one as long as buyers regard the price of milk as of more account than the quality. This kind of fraud is readily detected by finding the specific gravity and percentage of fat in the milk; but when skimmed milk instead of water has been added to whole milk, it is often impossible to prove the fact by any kind of examination, because the change of composition thus introduced may be less than the

natural variations. In the city of New York it is made illegal to offer for sale or even to bring into the city skimmed milk, on the ground that if it once comes into the city it is entirely impossible to exercise such a control as to prevent its sale as whole milk.

Skimmed milk itself is a legitimate article of trade, and a healthful article of food for adults. It is unsuitable for the exclusive food of infants, and its sale with the express or tacit understanding that it is whole milk, is both fraudulent and dangerous to the public health. It has been shown in Berlin and other cities, that infant mortality decreases as the milk control on the part of the authorities becomes more efficient.

In view of the fact that by a law* passed at the last session of the Legislature, the Station may be called upon to decide as to the purity of suspected samples of milk, it was deemed advisable to gather some statistics with regard to the composition of milk found in our market, and in connection with the present discussion these detailed results will be of interest. (See p. 91.) Of these samples 29 were bought of grocers and bakers, 4 direct from milk carts, and 5 represent what was delivered to private families by milk peddlers.

Nos. 5, 8, 15, 19, 24, 29, have undoubtedly been watered, as is indicated by their specific gravity, taken in connection with the high content of water and low content of fat. The lactometer so far as tried, indicated the same thing except in No. 29.

Nos. 6 and 32 are of doubtful purity, though 32 is cleared by the lactometer test. Nos. 18, 31 and 33 have a high specific gravity, while the solids and fat are quite low, which strongly indicates a mixture of skimmed milk with whole milk.† No. 37 has probably been both skimmed (imperfectly) and watered. If it had been skimmed only, the specific gravity would have been much higher; if watered only the fat would have been higher and the specific gravity lower. No. 3 is wholly anomalous on account of its high percentage of fat, accompanied with low percentages of solids and casein and its low specific gravity.

All the samples taken from milk carts and from what was delivered to private families were of fair quality. 13 out of 29 samples obtained from groceries were of poor quality, and in 7 cases the milk had certainly been watered or skimmed or both.

* See p. 92.

† These *samples* may have been unintentionally skimmed by the removal of the top milk from the can before they were taken.

In every case but one, the price paid was that of whole milk, namely, 4 cents a pint; No. 24 only, was sold for 3 cents.

ANALYSES OF MILK SOLD IN NEW HAVEN.

| Station No. | Specific Gravity. | Water. | Solids. | Casein. | Fat. | Degrees New York Board of Health Lactometer. |
|---|---|---|---|---|---|---|
| 1 | 1.030 | 87.63 | 12.37 | 2.61 | 4.11 | --- |
| 2 | 1.032 | 86.93 | 13.07 | 3.62 | ---- | --- |
| 3 | 1.027 | 88.09 | 11.91 | 2.66 | 4.56 | --- |
| 4 | 1.034 | 87.16 | 12.84 | 3.51 | 3.47 | --- |
| 5 | 1.024 | 92.05 | 7.95 | 2.11 | 2.04 | --- |
| 6 | 1.029 | 88.63 | 11.37 | 2.89 | 3.60 | --- |
| 7 | 1.032 | 87.17 | 12.83 | ---- | 3.95 | --- |
| 8 | ---- | 91.20 | 8.80 | ---- | 2.83 | --- |
| 9 | 1.031 | 87.17 | 12.83 | 3.32 | 4.06 | --- |
| 10 | 1.034 | 87.66 | 12.34 | 3.58 | 3.22 | --- |
| 11 | 1.035 | 86.79 | 13.21 | 3.38 | 3.09 | --- |
| 12 | 1.034 | 86.58 | 13.42 | 3.29 | 4.45 | --- |
| 13 | 1.034 | 87.44 | 12.56 | 3.29 | 3.83 | --- |
| 14 | 1.032 | 87.44 | 12.56 | ---- | 3.97 | 109 |
| 15 | 1.0256 | 90.26 | 9.74 | ---- | 2.83 | 91 |
| 16 | 1.0310 | 86.97 | 13.03 | ---- | 4.27 | 113 |
| 17 | 1.0322 | 86.67 | 13.33 | ---- | 4.54 | 115 |
| 18 | 1.0337 | 88.32 | 11.68 | ---- | 2.93 | 122 |
| 19 | 1.0267 | 89.79 | 10.21 | ---- | 2.40 | 94 |
| 20 | 1.0306 | 87.08 | 12.92 | ---- | 4.29 | 113 |
| 21 | 1.0322 | 87.91 | 12.09 | 2.88 | 3.35 | --- |
| 22 | 1.0329 | 86.92 | 13.08 | 3.31 | 4.21 | --- |
| 23 | 1.0339 | 86.94 | 13.06 | ---- | 3.97 | --- |
| 24 | 1.0239 | 89.82 | 10.18 | ---- | 3.52 | 85 |
| 25 | 1.0340 | 87.25 | 12.75 | ---- | 3.49 | 119 |
| 26 | 1.0348 | 86.80 | 13.20 | ---- | 4.08 | 120 |
| 27 | 1.0300 | 88.81 | 11.19 | ---- | 3.62 | 109 |
| 28 | 1.0313 | 88.80 | 11.20 | --- | 3.16 | 108 |
| 29 | 1.0286 | 89.83 | 10.17 | ---- | 2.51 | 102 |
| 30 | 1.0327 | 88.20 | 11.80 | ---- | 3.06 | 116 |
| 31 | 1.0356 | 88.33 | 11.67 | --- | 2 36 | 125 |
| 32 | 1.0290 | 88.42 | 11.58 | ---- | 3.16 | 110 |
| 33 | 1.0332 | 88.59 | 11.41 | ---- | 2.37 | 122 |
| 34 | 1.0301 | 88.35 | 11.65 | ---- | 3.46 | 112 |
| 35 | 1.0309 | 86.19 | 13.81 | ---- | 4.56 | 119 |
| 36 | 1.0312 | 87.14 | 12.86 | ---- | 3.99 | 119 |
| 37 | 1.0297 | 90.38 | 9.62 | ---- | 1.80 | 115 |
| 38 | ---- | 87.08 | 12.92 | ---- | 4.19 | --- |

*Control of Market Milk.*—The following method of exercising control over the quality of market milk, reported in the Milch Zeitung (1879, p. 205), is worth noticing here. In Brunswick, difficulty was met with in securing convictions for milk adulteration. The wording of the law was such that watering milk could be punished, but skimming could not be; and in many cases where there was very little doubt that milk had been watered, the sus-

pected parties had the benefit of the doubt, and were acquitted. In this dilemma, the authorities had the milk examinations continued as before, and from time to time a record of them was published. The report first stated that in Brunswick 11.1 was regarded as the minimum per cent. of solids in pure milk and 2.2 per cent. as the minimum of fat. Then followed the names and residences of the sellers and the results of analyses of the milk bought of them, giving specific gravity, solids and fat. While in cases of skimming no prosecutions were attempted, the moral effect of the arrangement was salutary, and the result on the quality of the milk supply, satisfactory.

This method, similar to that which, applied to Commercial Fertilizers has worked well in Connecticut, might probably be adopted to advantage in our large towns.

The present State law with regard to the sale of milk is as follows:

## An Act to Prevent the Adulteration of Milk.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

Section 1. Whoever shall knowingly sell, supply, or bring to be manufactured to any butter or cheese manufactory in this State any milk diluted with water, or adulterated by the addition of any foreign substance, or from which any cream or milk commonly known as strippings has been taken; or whoever shall knowingly bring or supply milk to any butter or cheese manufactory that is tainted or partly sour, shall, for each offense, forfeit and pay a sum not less than twenty-five dollars nor more than one hundred dollars with cost of suit, to be sued for in a court of competent jurisdiction, for the benefit of the person or persons, firm or association, or corporation, or their assigns, upon whom such fraud shall be committed.

Sec. 2. The usual test for quality and the certificate of analysis of the director of the Connecticut Agricultural Experiment Station shall be deemed *prima facie* proof of adulteration.

Sec. 3. No person shall sell, or expose for sale any milk from which the cream or any part thereof has been removed, without distinctly and durably affixing a label, tag, or mark of metal in a conspicuous place upon the outside, and not more than six inches

from the top of every can, vessel, or package containing such milk, and such metal label, tag, or mark shall have the words "Skimmed Milk" stamped, printed, or indented thereon in letters not less than one inch in height, and such milk shall only be sold or retailed out of a can, vessel or package so marked.

SEC. 4. No person shall sell or offer for sale, or shall have in possession with intent to sell or offer for sale, any impure or adulterated milk.

SEC. 5. Every person who shall violate the provisions of sections three and four of this act shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined not more than seven dollars, or be imprisoned not more than thirty days or both.

SEC. 6. A printed notice of this law shall be conspicuously posted in all public places, creameries, or factories where milk is received or sold.

Approved, April 25, 1882.

## SEED TESTS.

BY DR. E. H. JENKINS.

In the following table are given the results of twenty-four seed tests, some of them made in the interest of dealers and some for private parties.

The percentage of seed which germinates in these laboratory tests does not, and is not claimed to represent exactly the amount which will actually grow to produce healthy plants in farm practice. A seed is counted as good when the rootlet has burst the seed coat and grown to the length of a millimeter, ($\frac{1}{25}$ inch), in an apparently healthy manner. It may not, however, have strength enough left to push its way to the surface of the ground and develop normally. On the farm the success of a planting depends on many things besides the vitality of the seed, viz: on depth of planting, temperature, moisture, etc., and when complaint is made of a poor "catch," the seedsman is slow to acknowledge that the trouble was in the seed rather than in the manner of planting, or the unfavorable weather prevailing at the time. Since in a carefully conducted laboratory test the access of air and light to the seed, the supply of moisture and the temperature can all be very perfectly regulated, the results will in all

cases do full justice to the dealer, while they furnish to the purchaser a very fair idea of the quality of the stock. It should be remembered that while seed is too often put on the market which is known by the seller to be old and poor, there may be great differences in the quality of new seed, occasioned by the weather, and other less obvious causes, differences which may not be appreciated by the seed grower himself until the next planting. Cases have come to our notice repeatedly, where fresh seed was sold by one dealer to another which was almost worthless.

| Variety. | Station No. | Seed sprouted. Per cent. | Seed remained sound. Per cent. | Seed rotted. Per cent. | One-half sprouted seed germinated in days. |
|---|---|---|---|---|---|
| CLOVER: | | | | | |
| Red Clover | **158** | 75.8 | 7.5 | 16.7 | 5 |
| TIMOTHY | **159** | 90.5 | 5.5 | 4.0 | 6 |
| OATS | **146** | 94.5 | 1.0 | 4.5 | 3 |
| | **147** | 95.0 | 1.0 | 4.0 | 3 |
| MAIZE: | | | | | |
| Mammoth Sweet | **110** | 14.0 | 0.0 | 86.0 | 5 |
| Moore's Concord Sweet | **141** | 38.0 | 0.0 | 62.0 | 5 |
| Minnesota Sweet | **142** | 94.0 | 0.0 | 6.0 | 3 |
| Evergreen Sweet | **143** | 43.0 | 0.0 | 57.0 | 3 |
| " " | **145** | 92.0 | 0.0 | 8.0 | 3 |
| Crosby's Sweet | **144** | 90.5 | 0.0 | 9.5 | 3 |
| CABBAGE: | | | | | |
| Jersey Wakefield | **137** | 12.7 | 0.0 | 87.3 | 4 |
| " " | **157** | 71.8 | 4.5 | 23.7 | 5 |
| Flat Dutch | **150** | 75.8 | 0.0 | 24.2 | 2 |
| | **149** | 46.3 | 4.5 | 49.2 | 4 |
| SAGE | **152** | 39.8 | ? | ? | 9 |
| | **153** | 26.7 | ? | ? | 14 |
| ONION: | | | | | |
| Red | **138** | 44.3 | 34.7 | 21.0 | 3 |
| Wethersfield large red | **139** | 82.7 | 0.0 | 17.3 | 1 |
| | **151** | 59.5 | 12.0 | 28.5 | 6 |
| Yellow Danvers | **155** | 47.8 | 9.5 | 42.7 | 5 |
| " " | **156** | 86.8 | 1.0 | 12.2 | 5 |
| " " | **118** | 88.5 | 0.5 | 11.0 | 3 |
| " " | **148** | 44.0 | ? | ? | 5 |
| LEEK | **154** | 48.5 | 18.5 | 33.0 | 7 |

The sample of Oats No. 147, was from a lot purchased in this State, and was sent to the Station for examination, because, so it was asserted, horses refused to eat it. The oats were very musty

and were probably unpalatable only on that account. They contained a very small percentage by weight, of seed of foxtail grass, (*Setaria viridis*, and a little *S. glauca*,) and a few seeds of weeds (*Polygonum* and *Chenopodium*.) They weighed 36 lbs. to the bushel and were of average vitality.

The samples of maize seed were all grown in Rochester, N. Y., purported to be of the crop of 1880, and were examined four months after harvest.

Nos. 140, 141 and 143 are of very poor quality and worthless for seed, though the kernels are of average size and weight. The samples named, however, had a yellow dull look instead ot being bright and translucent, which made the purchaser, a seedsman, doubtful of their value.

That year the corn was late, bad weather set in, and it heated in the crib. The proper curing of sweet corn is a rather delicate matter. We understand that some growers now cure it in kilns with perfect success.

Of the samples of Onion Seed, No. 138 purported to be of the last crop, and was tested March 1. The large percentage of seed remaining hard at the end after trial (34.7 per cent.), makes it appear very probable that it was in part or altogether old seed.

Numerous trials made at this Station with onion seed, whose age was certainly known, gave an average of 6 per cent. of hard seed at the end of the trial (in only one case as high as 19 per cent.), when the seed was less than one year old; 23 per cent. when between one and two years old; 52 per cent. when between two and three years old; 68 per cent. when between three and four years old; and 88 per cent. when five years old.*

No. 148 is a sample of the small, light seed, which is winnowed off before the seed is put on the market. It is one-third lighter than that which is marketable and its vitality is small.

No. 118 represents the marketable portion of the same crop as No. 148.

The average amount of seed capable of germination, as found in tests reported in North Carolina, and in this State is, in case of—

| | |
|---|---|
| Red clover (8 tests), | 78.2 per cent. |
| Timothy (6 tests), | 86.3 per cent. |
| Cabbage (6 tests), | 79.5 per cent. |
| Onion (40 tests), | 83.3 per cent. |

* Report of this Station for 1880, p. 98.

The Station's instructions for sampling seeds, are as follows :

THE CONNECTICUT

## AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

---

### INSTRUCTIONS FOR SAMPLING SEEDS.

The *Purity and Germinating Power* of Seeds intended for Farm and Garden use are learned by examining a small average sample. A weighed amount of seed is taken, the pure seeds are culled out and weighed, foreign matters and especially noxious seeds are identified, the vitality of the pure seed is tested by careful sprouting trials, and a report is drawn up of the results.

As the test of germinating power requires some time for its completion, a report on samples sent in cannot be ordinarily expected in less than two weeks.

The examination of *grass-mixtures* can only be undertaken in special cases. It requires a large outlay of time and labor which is not often justified by the results.

In selecting a sample for examination the greatest care should be used to have it represent accurately the whole amount from which it was taken. This result will be secured by proceeding as follows :

1. Mix well together with the hand and arm the contents of the package (bag or barrel) or packages of seed.

2. Take out five or six small handfuls or cupfuls* from various parts of the package, mix these together and take a part of this mixture for the sample.

3. Send of the smaller seeds—red top, white clover, timothy, etc., two (2) ounces; of beets, turnips, red clover, etc., four (4) ounces; of wheat and cereals, and of peas and other legumes, eight (8) ounces.

4. Samples may be sent by mail, or otherwise, prepaid, and should be *plainly labeled* and addressed to

CONN. AGRICULTURAL EXPERIMENT STATION,
New Haven, Conn.

* A small cup may be closed with the palm of the hand, forced down to the desired place, then filled and withdrawn.

Seeds sent in for gratuitous examination must be described on the subjoined form.

THE CONNECTICUT

## AGRICULTURAL EXPERIMENT STATION,

NEW HAVEN, CONN.

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FORM FOR DESCRIPTION OF SAMPLE.

Station No.............Received at Station, ........................188 .

Each sample of seed sent for gratuitous examination must be accompanied by one of these Forms, with the blanks *below* filled out as fully as practicable.

This Form, filled out and sent with the sample, will serve as a label; but it should be returned *in good order* for filing in the Station Records.

Send with each sample a specimeu of any printed circular, or statement that accompanies the seed or is used in its sale.

Name or label of seed, ..........................................

..........................................................

..........................................................

Name and address of Producer or Importer, ..........................

..........................................................

..........................................................

Name and address of Dealer from whose stock this sample is taken.

..........................................................

..........................................................

Date of taking this Sample, ......................................

Selling price per pound or bushel, ................................

Known or reputed age of seed, ....................................

Number of packages from which sample is taken, ....................

Signature and P. O. address of person taking and sending the sample.

..........................................................

..........................................................

The results of the examination are reported to the party sending, on a form of which the following is an example:

## REPORT OF SEED TEST.

THE CONNECTICUT

## AGRICULTURAL EXPERIMENT STATION.

NEW HAVEN, CONN., 188 .

*Examination of*

*Rec'd* 188 Station No.

*From*

| | | |
|---|---|---|
| Pure seed, | | per cent. by weight. |
| Impurities, | | per cent. by weight. |
| Pure seed sprouted during | days, | per cent. by number. |
| Pure seed decayed during | days, | per cent. by number. |
| Pure seed sound (unsprouted) after | days, | per cent. by number. |
| Of sprouted seed, ½ germinated in | | days. |
| 1000 seeds weighed | | grams. |
| Per cent. value, | | |

The "per cent. value" of a sample of seed is obtained by multiplying its per cent. (by weight) of pure seed into the per cent. (by number) found, or able, to germinate, and dividing by 100. It refers the number of seeds found, or able, to germinate, from "pure seed" back upon the sample itself, in terms of per cent. In case of *perennials only* it takes account of ⅓ of the unsprouted sound seeds, the proportion which, on an average of many observations, has been found to germinate under favorable conditions.

*Director.*

## FEEDING STUFFS.

Twenty samples of Feeding Stuffs have been under examination during 1882, viz:

4 of Maize Fodder.
4 of Maize Ensilage.
8 of Hay.
1 of Rice Feed.
1 of Cotton Seed Meal.
1 of Corn Meal.
1 of Wheat Bran.

### Maize Fodder and Ensilage.

About September 1, 1881, Dr. M. Miles, recently in charge of the Experimental Department of Houghton Farm, sent to the Station samples of Maize Fodder both from "Field Corn" i. e., Maize planted in hills as usual for the crop of grain, and from "Fodder Corn" or Maize sown more thickly in drills, for the crop of stalks and leaves. These samples were selected with especial care, in duplicate, and dispatched at once to the Station in close boxes. At the same time weighed quantities of the same material were put in a silo where they remained until about the middle of January, 1882, when they were taken out and sent to the Station.

Analyses (more or less complete) of all these samples were made with the prime object of learning something of the kind and degree of chemical change which occurs in the silo. As a control on the results, each of the duplicate samples of the fresh maize stalks were separately examined in order to ascertain what amount of variation in the analyses is attributable to imperfect sampling, it being evidently no easy matter to take from a mass of maize stalks two small portions that exactly correspond in composition to each other or to the mass. The results of the analyses are tabulated on p. 100.

Comparing the analyses of the duplicate samples of Field Corn CXXV and CXXVI we notice that the water content of the fresh material as received at this Station, differs 0.85 per cent. This difference is no doubt partly due to unavoidable errors in the subsampling, drying and weighing, in part also no doubt to original and necessary inequality in the samples. The fat and wax (ether extracts) determined on the dry substance are identical. The albuminoids are reckoned from the amounts of nitrogen found in the dry substance by multiplying them by $6\frac{1}{4}$. Two nitrogen

| | Field Corn. | | | Fodder Corn. | | |
|---|---|---|---|---|---|---|
| | Fresh (Duplicates). | | Ensilaged. | Fresh (Duplicates). | | Ensilaged. |
| Station No. | CXXV. | CXXVI. | CXLIV. | CXXVII. | CXXVIII. | CXLV. |
| Weight when sent | 13 lbs. 0 oz. | 13 lbs. 0 oz. | 13 lbs. 0 oz. | 11 lbs. 2½ oz. | | 11 lbs. 2½ oz. |
| Weight when received | 12 lbs. 10 oz. | 13 lbs. 1½ oz. | 12 lbs. 11¼ oz. | 10 lbs. 14 oz. | 9 lbs. 11 oz. | 11 lbs. 6¾ oz |
| When received | Aug. 29, '81. | Aug. 29, '81. | Jan. 12, '82. | Sept. 1, '81. | Sept. 1, '81. | Jan. 12, '82. |
| Water | 79.72 | 80.57 | 82.38 | 87.15 | 86.45 | 87.68 |
| Ash | 1.07 | | 1.05 | .87 | | .91 |
| Albuminoids* | 1.78 | 1.87 | 1.39 | 1.54 | 1.16 | 1.38 |
| Crude Fiber | 4.73 | | 4.80 | 4.19 | | 4.04 |
| N. fr. Extract† | 12.46 | | 9.96 | 6.06 | | 5.62 |
| Ether Extract (fat, etc.) | .24 | .23 | .42 | .19 | .19 | .37 |
| | 100.00 | | 100.00 | 100.00 | | 100.00 |
| *Water Free.* | | | | | | |
| Ash | 5.26 | | 5.98 | 6.77 | | 7.42 |
| Albuminoids* | 8.79 | 9.64 | 7.87 | 11.95 | 8.56 | 11.25 |
| Crude Fiber | 23.33 | | 27.24 | 32.62 | | 32.83 |
| N. fr. Extract† | 61.43 | | 56.56 | 47.20 | | 45.50 |
| Ether Extract (fat, etc.) | 1.19 | 1.19 | 2.35 | 1.46 | 1.49 | 3.00 |
| | 100.00 | | 100.00 | 100.00 | | 100.00 |

* Reckoned as total nitrogen × 6.25.

† Nitrogen-free extract includes carbhydrates (sugar, gum, etc.).

determinations on each sample gave practically the same result. The discrepancy in albuminoids of 0.85 per cent. therefore lies mainly in the sampling.

Turning now to the duplicate Fodder Corn samples we find 0.7 per cent. in the water content. The ether extracts are not essentially discrepant, but the albuminoids differ by 3.39 per cent. This large difference is unquestionably for the most part due to inequality of the original samples as the two nitrogen estimations on each sample agreed perfectly.

Comparing now, on water-free substance, the composition of the ensilage with that of the corn itself, we get no satisfactory evidence of any change in the albuminoids, for the amount found in the field corn ensilage is but 1.34 per cent. less than the average result on the field corn itself, while in case of fodder corn the albuminoids found in the ensilage are 1 per cent. more than the average obtained in the fresh corn. As regards the "Ether Extracts" we observe that in both cases the ensilage contains very nearly double what was got from the fresh corn. In ordinary fodder-analyses the ether extract consists for the most part of oil, fat or wax, and is usually termed fat or crude fat. In the process of ensilage it is not so likely that fat is produced as that lactic acid is formed, perhaps mainly during the sampling and sending (by transformation of sugar), which dissolves freely in ether.

That sugar and perhaps other carbhydrates are to some degree destroyed and lost by fermentation in the silo, is proved by the appearance of fermentation-products, especially carbonic acid gas. Such loss would tend to diminish notably the percentage of nitrogen-free extract and to increase that of the crude fiber. At first glance the analyses of the Field Corn and its ensilage would seem to indicate a considerable loss in this way, for the fiber of the ensilage is nearly 4 per cent. greater than that of the corn, and its carbhydrates, etc. (N. fr. Extract), nearly 5 per cent. less. But the results for Fodder Corn, though pointing in the same direction give much smaller differences (0.2 per cent. less fiber and 1.7 per cent. more N. fr. Extract), differences that bear no proper relation to each other to be accounted for by loss in fermentation, and that are easily attributable to errors of analysis and uneven sampling. Even the larger differences of 4 and 5 per cent. found in case of the Field Corn might be due to differences in the original samples, for if in the albuminoids there could be in two samples a difference of 3.4 per cent., twice that variation should be anticipated on the three times more abundant fiber and carbhydrates.

We conclude then that these analyses demonstrate that this method of working is incompetent to give any clear notions as to the quantity or even as to the kind of changes that go on in the silo. This result was not unexpected, nevertheless, we regarded the questions involved worthy of careful experimental study.

The antiseptic quality of acids, especially of carbonic acid gas, which has lately been demonstrated by Kolbe, is such as to lead to the conclusion that no considerable amount of chemical change or of loss of nutritive matters can go on in the well constructed silo. Dr. Neale has, we believe, found further experimental evidence of that conclusion in recent investigations at the New Jersey Experiment Station.

## Broad Rock Farm Ensilage.

A valuable contribution to the literature of Ensilage has been recently made by Mr. Rowland Hazard, of Peace Dale, R. I., President of the Washington County (R. I.) Agricultural Society.

A sample of Mr. Hazard's ensilage was analyzed at the Station, and the results are here given, together with Mr. Hazard's comments, taken from a memorandum printed by him.

The ensilage was made from corn "cut in September, after the ears were well advanced," on the principle that "the first condition of success with a silo, is to have a good crop to put into it."

"Analysis of Ensilage from Broad Rock Farm made at the Connecticut Agricultural Experiment Station. March, 1882. Six months after storage.

| | | | Seventeen other Samples. | |
|---|---|---|---|---|
| | R. Hazard's Sample. | | Minimum in any case of the seventeen. | Maximum in any case of the seventeen. |
| Water, | 77.648 | ---- | 74.2 | 84.9 |
| Ash, | 1.779 | ---- | 0.8 | 1.8 |
| Protein, | 2.005 | ---- | 0.9 | 1.9 |
| Crude Fibre, | 6.018 | ---- | 4.7 | 7.9 |
| Sugar (Glucose), | 0.255 | | | |
| Acetic Acid,* | .103 | 12.003 | 7.0 | 13.0 |
| Alcohol,* | .396 | | | |
| Other Carbhydrates, | 11.249 | | | |
| Fat (Ether extract), | .547 | ---- | 0.3 | 0.9 |
| | 100.000 | | | |

* Alcohol was not positively proven to be present to the extent given, but the figures are probably not far from correct. The amounts of both alcohol and acetic acid may easily increase (or change) after the sample leaves the silo, during its transportation or while it awaits the operations of analysis. There is no probability that the ensilage as fed was so sour or so alcoholic as when analyzed. In fact, the odor of ensilage fresh from the silo is, so far as the writer has had opportunity to observe, much less acid than that which has been received at the station for analysis.

"From this analysis the Broad Rock Farm sample is seen to be nearly 40 per cent. better than the best of seventeen* other samples analyzed. It is nearly equal to good grass, and has an apparent nutritive value of about 2½ lbs. of ensilage to 1 of good hay.

"The cost of 2½ tons ensilage = \$7.50. A fair estimate for 1 ton of hay = \$12."

"COST OF ENSILAGE AT BROAD ROCK FARM. SEPTEMBER, 1881.

| | |
|---|---|
| Ploughing 9 acres, 9 days, 1 man and pair of oxen at \$2.50 per day, | \$ 22.50 |
| Seed (part at \$4 per bushel, which is useless expense), | 9.50 |
| Manure, including ⅔ of value and hauling and spreading, | 135.00 |
| Planting, 5 days, 2 men and 1 horse at \$3.50, | 17.50 |
| Cultivating, 4 days, 1 man and 1 horse, | 9.00 |
| Cutting, 13 men and 2 teams for 6 days, | 120.00 |
| Coal for steam engine, | 14.00 |
| | \$327.50 |
| Add for repairs on machinery, salt and extras, | 32.50 |
| | \$360.00 |

"The quantity of ensilage was 120 tons; cost, excluding the interest on land and on silos, \$3 per ton.

"The cost per ton on hay for interest and storage is of course much larger than for ensilage."

"EXPERIMENT IN FEEDING ENSILAGE AT BROAD ROCK FARM. EXPERIMENT BEGAN FEB. 16, 1882, WITH TEN AVERAGE COWS. THE ENSILAGE HAD BEEN STORED FULLY FIVE MONTHS.

"Taste of ensilage decidedly sour, and subsequent analysis as above showed $\frac{103}{1000}$ of 1 per cent. acetic acid. This is equal to about a quart of strong vinegar per 100 pounds. From Feb. 16 fed the ten cows thus, per day: Ensilage at two feeds, 17 lbs. each feed = 34 lbs. per cow. Hay at one feed, 7 lbs. each feed = 7 lbs. per cow. Meal 2 quarts and bran 4 quarts per cow per day. Fed for 7 days, yield of milk was 68 quarts per day. Then changed the feed of the same cows and gave them no ensilage, but instead gave 14 lbs. of hay, making total hay 21 lbs. per day per cow, with meal and bran same as before, and fed for 7 days. Yield of milk was 59 quarts per day. Then changed back to feed same as in the first 7 days, and fed for 7 days. Yield of milk was 66 quarts per day.

*In Mr. Hazard's original memorandum eleven other samples were compared.

"From this it appears that 34 lbs. of ensilage is 12 per cent. better than 14 lbs. of hay. The hay, at $12 per ton, cost 8.4; ensilage, at $3 per ton, cost 5.1. Making allowance for the 12 per cent. better result, we have 9.4 cents hay = 5.1 cents ensilage.

"This shows also that 2½ lbs. of ensilage will more than replace 1 lb. of hay; for, reduce 34 lbs. by 12 per cent. = 30 lbs. and 30 lbs. then would equal 14 lbs. hay, or 1 lb. hay = $2\frac{1}{7}$ ensilage."

## Analyses of Hay and Stover.

The subjoined partial analyses made for Prof. Armsby on samples sent by him from the Storrs Agricultural School are here put on record. They confirm the formerly published results of similar analyses. The low content of albuminoids in the timothy and red-top is especially noticeable.

| Station No. | Kind of Hay. | When Cut. | Analysis. Water. | Albminoids. | Fiber. |
|---|---|---|---|---|---|
| CXXXIII, | Clover, | July 10, | 16.07 | 9.36 | 29.41 |
| CXXXIV, | Clover Rowen,* | Sept. 1, | 16.62 | 13.00 | 25.10 |
| CXXXII, | | Middle of July, | 12.96 | 4.68 | 28.39 |
| CXL, | Timothy and Red-top, | Middle of July, | 14.30 | 4.54 | 31.39 |
| CXXXI, | | Last of July, | 13.45 | 6.44 | 26.49 |
| CXLI, | Mixed Grasses, | Aug. 1, | 14.00 | 7.10 | 27.80 |
| CXXXIX, | Hungarian and some Red-top, | Last of Aug., | 15.37 | 6.81 | 36.00 |
| CXXXV, | Swale, | August, | 14.64 | 5.88 | 25.44 |
| CXXXVI, | Stover, | Sept. 12, | 28.71 | 3.00 | 24.53 |

* From the same field as No. CXXXIII.

CXXXVII. Rice Feed. From stock of Holmes and Keeler, Norwalk. Sampled and sent by D. H. Van Hoosear, Wilton.

Analysis.

| | | Water-free. |
|---|---|---|
| Water, | 10.33 | ---- |
| Ash, | 9.62 | 10.70 |
| Albuminoids, | 11.43 | 12.74 |
| Crude Fiber, | 9.93 | 11.03 |
| N. fr. Extract (carbhydrates), | 47.20 | 52.72 |
| Fat, | 11.49 | 12.81 |
| | 100.000 | 100.00 |

The composition of this Rice Feed is very near that of average oats or the best maize in respect to albuminoids. It has three times the ash of oats, twice the fat, the same amount of fiber, and fourteen per cent. less carbhydrate. The less carbhydrates are about compensated by the more fat.

## OBSERVANCE OF THE FERTILIZER LAW.

MANUFACTURERS *who up to Jan. 16, 1883, have complied with Sections 2 and 3 of the Act concerning Commercial Fertilizers, which went into effect Sept. 1, see page 11, and have sent samples to the Station and paid Analysis Fees to the Director:*

| Firm. | Article. |
|---|---|
| Glidden & Curtis, Boston, Mass. | Soluble Pacific Guano. |
| G. W. Dickenson, Essex, Ct. | Ivory and Bone Dust. |

The two fertilizers above-named are accordingly the only ones selling at $10 or over per ton, whose sale in Connecticut has been legal, from Sept. 1, 1882, to Jan. 16, 1883.

DEALERS *who up to Jan. 16, 1883, have complied with Section 4 of the Act concerning Commercial Fertilizers, see page 11, and reported to the Director of this Station their names, residences and post-office addresses, and the names and brands of fertilizers sold, with the name and address of the manufacturers, importers or parties from whom such fertilizers were obtained:*

| Dealers. | Article. | Manufacturer. |
|---|---|---|
| J. P. Barstow, Nor'ch. | Americus Bone Meal, | Rafferty & Williams. |
| J. P. Barstow, Nor'ch. | Crescent (?) Ground Bone. | Lister Bros. |
| J. P. Barstow, Nor'ch. | Amm. Bone Superphosphate. | E. F. Coe. |
| J. S. Benton, Guilford. | Pure Ground Bone, extra fine, | Mapes F. & P. G. Co. |
| J. S. Benton, Guilford. | Mapes Comp. Man. for light soils, | Mapes F. & P. G. Co. |
| J. S. Benton, Guilford. | Mapes Comp. Man. A. Brand, | Mapes F. & P. G. Co. |
| J. S. Benton, Guilford, | Mapes Corn Manure, | Mapes F. & P. G. Co. |
| J. S. Benton, Guilford. | Mapes Potato Manure, | Mapes F. & P. G. Co. |
| G. S. Clark, Washington Depot, Ct., | A. Brand Complete Manure, | Mapes F. & P. G. Co. |
| Geo. W. Denison, Old Saybrook, | Lister Bros. Ground Bone, | Lister Bros. |
| Geo. W. Denison, | Lister Bros. Phosphate. | Lister Bros. |
| W. H. Scott & Co., Pequabuck, Litchfield Co., Ct., | Ground Bone. | Peck Bros. |
| W. H. Scott & Co., Pequabuck, Litchfield Co., Ct., | Bradley's Superphosph. of Lime. | Bradley Fertilizing Co. |
| Wilson & Burr, Middletown. | Stockbridge Manure for Grain, | Bowker Fertilizer Co. |
| Wilson & Burr, | Pure Ground Bone. | Rogers & Hubbard Co. |
| Wilson & Burr, | Stockbridge Man. for Potatoes, | Bowker Fertilizer Co. |
| Wilson & Burr, | Quinn. Fish and Potash, No. 1, | Quinn. Fertilizer Co. |
| Wilson & Burr. | Quinn. Phosphate, | Quinn. Fertilizer Co. |
| Wilson & Burr, | Ground Land Plaster, | G. W. Miller, Middlefield |
| Wilson & Burr, | Stockbridge Manures. | Bowker Fertilizer Co. |

## LEGISLATIVE ACTS RELATING TO THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

### AN ACT ESTABLISHING THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

SECTION 1. That for the purpose of promoting agriculture by scientific investigation and experiments, an institution is hereby established, to be called and known as The Connecticut Agricultural Experiment Station.

SEC. 2. The management of this institution shall be committed to a Board of Control, to consist of eight members, one member to be selected by the State Board of Agriculture, one member by the State Agricultural Society, one member by the Governing Board of the Sheffield Scientific School at New Haven, and one member by the Board of Trustees of the Wesleyan University at Middletown, and two members to be appointed by the Governor of this State, with the advice and consent of the Senate. The Governor of the State, and the person appointed as hereinafter provided to be the Director of the Station, shall also be *ex officio* members of the Board of Control.

SEC. 3. After the appointment of the members of the Board of Control as aforesaid, said members shall meet and organize by the choice from among their number of a President, a Secretary, and a Treasurer, who shall be elected annually, and shall hold their respective offices one year, and until the choice of their successors. Five members of said Board shall constitute a quorum thereof for the transaction of business.

SEC. 4. Said Board shall meet annually after the first meeting thereof, on the third Tuesday in January in each year, at such place in the city of Hartford as may be designated by the President of said Board, and at such other times and places, upon the call of the President, as may be deemed necessary, and may fill vacancies which may occur in the officers of said Board.

SEC. 5. Said Board of Control shall locate and have the general management of the institution hereby established, and shall appoint a Director, who shall have the general management and oversight of the experiments and investigations which shall be necessary to accomplish the objects of said institution, and shall

employ competent and suitable chemists and other persons necessary to the carrying on of the work of the Station. It shall have power to own such real and personal estate as may be necessary for carrying on its work, and to receive title to the same by deed, devise, or bequest. It shall expend all moneys appropriated by the State in the prosecution of the work for which said institution is established, and shall use for the same purpose the income from all funds and endowments which it may hereafter receive from other sources, and may sue and be sued, plead and be impleaded, in all courts, by the name of The Connecticut Agricultural Experiment Station. It shall make an annual report to the Legislature which shall not exceed two hundred printed pages, of which not exceeding three thousand copies shall be printed.

SEC. 6. The sum of five thousand dollars annually is hereby appropriated to said Connecticut Agricultural Experiment Station, which shall be paid in equal quarterly installments to the Treasurer of said Board of Control, upon the order of the Comptroller, who is hereby directed to draw his order for the same; and the Treasurer of said Board of Control shall be required, before entering upon the duties of his office, to give bond with surety to the Treasurer of the State of Connecticut in the sum of ten thousand dollars, for the faithful discharge of his duties as such Treasurer.

SEC. 7. Upon the death or resignation of any of the members of the Board of Control, the authority or institution by which such deceased member was originally appointed shall fill the vacancy so occasioned.

SEC. 8. Professor Samuel W. Johnson, of New Haven, is hereby empowered to appoint and call the first meeting of said Board of Control as soon as may be practicable after the appointment of the members thereof, and he shall notify all said members of the time and place of said meeting. Two of said members shall hold office for one year, two of them for two years, and two of them for three years; and at said first meeting they shall determine by lot which of said members shall hold office for one year, which for two years, and which for three years. All members of said Board thereafter chosen or appointed, except such as are appointed or chosen to fill vacancies in said Board, shall continue in office for the term of three years from the first day of July next succeeding such appointment.

SEC. 9. This act shall take effect from its passage.

Approved March 21, 1877.

## An Act Relating to the Printing of the Report of the State Board of Agriculture and of the Connecticut Agricultural Experiment Station.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

Sec. 1. The Comptroller shall annually cause to be printed, at the expense of the State, five thousand copies each of the report of the State Board of Agriculture and of the Connecticut Agricultural Experiment Station.

Sec. 2. All acts and parts of acts inconsistent herewith are hereby repealed.

Approved, March 19, 1879.

## An Act Concerning the Connecticut Agricultural Experiment Station.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

Section 1. The sum of twenty-five thousand dollars is hereby appropriated to the Connecticut Agricultural Experiment Station for the purpose of buying a suitable lot and erecting thereon buildings, and equipping the same for the permanent use of said Station, but the title to such lot and to all buildings, and other improvements placed thereon shall be vested in the State of Connecticut.

Sec. 2. The Board of Control of said Connecticut Agricultural Experiment Station, or a duly authorized committee consisting of members of said Board of Control, shall have and exercise exclusive management, control, and expenditure of the sum appropriated by this act for the purposes aforesaid, shall select and determine the site, and the purchase thereof, the plans of said buildings, and the cost, construction, and equipment thereof, and shall pay for the same out of said sum; *provided always*, that the sum or sums so expended shall not exceed in the aggregate the sum hereby appropriated.

Sec. 3. The Comptroller is hereby authorized and directed to draw his order on the Treasurer of the State in favor of said Board of Control, in such amounts as from time to time said Board of

Control, or its duly authorized committee may require for the purposes aforesaid, not exceeding in the aggregate said sum of twenty-five thousand dollars, and a full and particular account shall be kept by said Board of Control of all moneys expended under this act, which account shall be audited by the Comptroller.

Approved, April 26, 1882.

## An Act Concerning the Connecticut Agricultural Experiment Station.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

Section six of chapter one hundred and fifty-eight of the Public Acts of 1877, being an act entitled An Act establishing the Connecticut Agricultural Experiment Station, is hereby amended so as to make the sum annually appropriated to said Station eight thousand dollars.

Approved, April 25, 1882.

## An Act Concerning Fertilizers.

(See pages 11–13.)

## An Act to Prevent the Adulteration of Milk.

(See page 94.)

# INDEX.

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For Errata see page 6.

# COMPOUND INDEX

TO THE REPORT OF THE BOARD OF AGRICULTURE AND OF THE AGRICULTURAL EXPERIMENT STATION.

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Folios starred refer to the Report of Experiment Station.